# HORNBROOK'S

## PRIMARY
## ARITHMETIC

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# PRIMARY ARITHMETIC

## NUMBER STUDIES

### FOR THE SECOND, THIRD, AND FOURTH GRADES

BY

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PRIM. ARITH. — HORNBROOK.

# PREFACE

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THE progress of a beginner in arithmetic is of a desirable kind when it involves a succession of insights into the relations of numbers and an increase of expertness in dealing with them. It is the aim of this first book to secure these ends. Its material has been chosen with careful reference to the development of the number sense of little children as observed by the author and as reported by many other observers.

It is believed that when a child realizes the meanings of the first ten number names, has learned to make combinations within 10, and is able to count to 100, he is ready to take up the first hundred as an aggregation of tens, to consider other numbers as aggregations, and to discover their relations. At that point this book begins.

The use of diagrams called "number tables" as a concrete basis for the child's thinking while he is getting his first ideas of the facts of the addition and multiplication tables is a distinctive feature of the work. Children readily learn from a number table like that on page 14 such facts as "5 tens = 50." The five columns of numbers are as concrete to them as five sticks, and the figures "50" at the end of the fifth column make them much more suggestive. Much of the work given in this book would be entirely too difficult for the children for whom it is intended if it lacked the basis of the measurements of the number tables.

The treatment of numbers used in this book leads to the presentation of the multiplication tables in an order different from that usually followed, and more economical of children's time and effort. 10, "the master key of number," under the decimal system, is presented first with its multiples. The child's instinct for grouping by pairs is next utilized by giving the table of twos. Work in addition and subtraction follows in which the relations of numbers to 10 and to 2 are frequently brought to mind. By objective work in feet and yards illustrating combinations in addition, the pupil gains a knowledge of multiples of 3. The smaller multiples of 4 are learned by similar work upon quarts and gallons, pecks and bushels. The fives as a subdivision of the tens are presented in the next chapter, and in order that the child may have time to become familiar with the multiples of 5, most of the work of that chapter relates to them. The child has been dealing with 10 and its divisions, and has had much practice in combining 10 with other numbers. To learn the table of elevens is an easy task for him. One little fellow remarked, "Learning the table of elevens is just like going down stairs, and you can always tell what step you are on. The first step is made of 1's and the second step is made of 2's, and it is that way all the way down." A glance at the oblique line made by the multiples of 11 in the number table on page 114 will explain his remark. 9, as a departure from 10 on the other side, is next given. The table of nines is reënforced by that of the threes, which receives formal treatment in the next chapter. The treatment of 8 is followed by that of its subdivision 4.

Work in fractions, which is generally so successful in first grades, is continued throughout the book in connec-

tion with simple geometric forms, and leads naturally to the recognition of ratios.

Only the rare, precocious child is able to found a process upon a course of reasoning, however clearly it may be presented. For that reason, only those processes of written work that can be based upon the child's intuitions of number are accounted for ; others are given simply as processes leading to desired results, without any attempt at forcing a knowledge of the underlying principles into the immature mind. The child is led to construct, to observe, to report, and to remember, but the reasoning required of him in the first book is limited to simple inferences.

Formal analysis, that most effective deadener of the mathematical sense of little children, has been omitted. The successful teacher knows how to stimulate the expression of the child's own insights into number by light, skillful touches upon his mind in easy conversational exercises.

The development of the plan of the work is indicated by many notes to the teacher.

To the many primary teachers who have kindly contributed the results of their schoolroom experiences, the author offers grateful acknowledgments.

# CONTENTS

The table of contents shows the chapter in which a subject first appears. Each subject reappears in succeeding chapters.

# ELEMENTARY ARITHMETIC

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## CHAPTER I

### SQUARES — COUNTING

Inch squares cut from white paper should be prepared in such abundance that each child may have enough to make the figures given in this chapter. Draw the figures on the blackboard and give the work orally at first.

**1.** How many squares in Fig. 1?

**2.** Place squares in a column like Fig. 1.

**3.** If we call the square at the top the first square, and the next one the second, and so on, how shall we number the last square? How shall we number the next to the last square?

**4.** Show the fourth square in your column. Show the sixth square, the ninth square, the third square, the seventh square, the fifth square, the eighth square.

**5.** Push the lowest two squares away. How many squares are left?

**6.** Make the column whole again. Take away four squares at the lower end of the column. How many squares are left?

**7.** Divide the column into two equal parts. How many squares in each part?

**8.** Take away from the whole column six squares, and tell how many are left.

Fig. 1

9
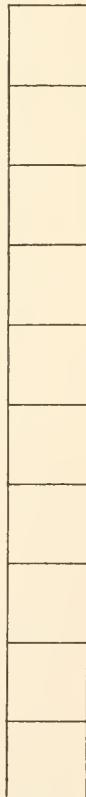
**9.** Take away from the whole column three squares, and tell how many are left.

Give exercises in parting and wholing the column of squares until the combinations up to 10 are thoroughly reviewed.
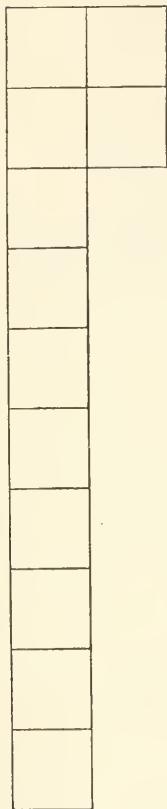
**10.** Place squares as in Fig. 2. How is it different from Fig. 1? How many squares in Fig. 2? 10 and 2 are how many?

**11.** Add 2 more squares to the short column. Tell how many squares there are now in the short column. How many in the whole figure? 10 and 4 are how many?

**12.** Add 2 more squares. How many squares in the short column now? How many in the whole figure? 10 and 6 are how many?

**13.** Add 2 more squares. How many squares in the short column? How many in the whole figure? 10 and 8 are how many?

**14.** Add squares to the short column until the columns are equal. How many did you add? How many squares in each column? How many in the whole figure? 10 and 10 are how many?

FIG. 2

**15.** Take away the last two squares from the figure you have. How many are left? 2 from 20 leave how many? Take away 2 more and tell how many are left. 2 from 18 leave how many?

**16.** Keep taking away two more and telling how many are left until the right-hand column is all gone. 2 from 16 leave how many? 2 from 14 leave how many? 2 from 12 leave how many?

Give similar exercises on successive days until these facts of number measurement have been called into the consciousness of the children so often and so clearly that they have become a part of their mental property. Do not let them memorize number statements such as "10 and 2 are 12" until it is evident that their statements are supported by their own perceptions of number truths.

**17.** Put the 20 squares back into 2 equal columns. Number them as in Fig. 3.

**18.** Find the 17th square. How many squares in this figure come after the 17th? How many squares before the 17th square are numbered in this figure?

**19.** Find the 15th square and show how many squares come after it. How many squares come before the 15th square in this figure? Show how many squares, in this figure, come after the 13th. After the 16th. After the 14th. After the 11th. After the 18th. After the 12th.

**20.**   3 from 20 = how many?
5 from 20 = how many?
8 from 20 = how many?
4 from 20 = how many?
6 from 20 = how many?
9 from 20 = how many?
2 from 20 = how many?
7 from 20 = how many?

| 1 | 11 |
|---|----|
| 2 | 12 |
| 3 | 13 |
| 4 | 14 |
| 5 | 15 |
| 6 | 16 |
| 7 | 17 |
| 8 | 18 |
| 9 | 19 |
| 10 | 20 |

FIG. 3

Let the children separate the figure before them into unequal parts of their own choosing, telling how many squares they take away, and how many are left.
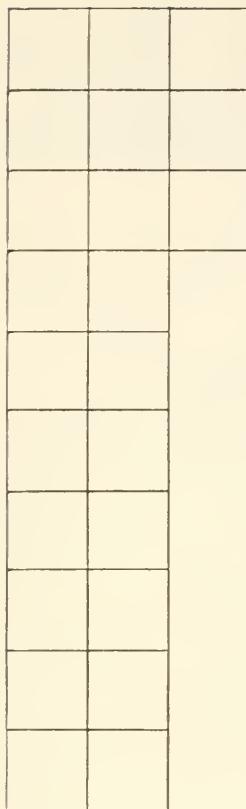
FIG. 4

**21.** Place squares as in Fig. 4. How many squares in it? How many more squares than in Fig. 3?

**22.** Show the 20th square in your figure.

Let the squares be counted in the order indicated in Fig. 3.

**23.** Show the 21st square and tell how many squares come after it.

**24.**    $21 + 2 =$ how many?

$20 + 3 =$ how many?

**25.** Add 2 squares to the short column. How many are there now in the short column? How many in the whole figure? $23 + 2 =$ how many?

**26.** Add 2 more squares and tell how many are in the short column. How many are in the whole figure? $25 + 2 =$ how many?

**27.** Add 2 more squares and tell how many are in the short column. How many are in the whole figure? $27 + 2 =$ how many?

**28.** Add squares enough to make the short column as long as the others. How many did you add? How many squares in your whole figure?

**29.** Divide the whole figure you have made into three equal parts. How many squares in each part?

**30.** $10 + 10 + 10 =$ how many?

**31.** 10 from 30 = how many?    4 from 30 = how many?

6 from 30 = how many?    3 from 30 = how many?

5 from 30 = how many?    7 from 30 = how many?

**32.** Place squares to make Fig. 5. How many squares does it take? $30 + 4 =$ how many?

**33.** Add 2 squares to the short column and tell how many squares in it. How many in the whole figure now? $34 + 2 =$ how many?

**34.** Add 2 more squares to the short column. How many in it now? How many in the whole figure? $36 + 2 = ?$

**35.** Add squares enough to make the short column equal to the others. How many did you add? How many are there in the whole figure? $38 + 2 = ?$

**36.** How many columns in the whole figure? Separate the figure into 4 equal parts. How many squares in each part?
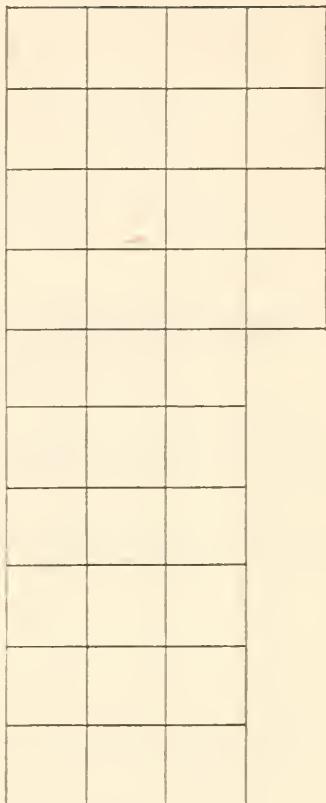
Fig. 5

**37.** Put the parts together again. Show the 31st square. How many squares come after it in the figure? How many are before it?

**38.** Show the 33d square and tell how many squares follow it; the 35th; the 32d; the 36th; the 38th.

**39.**  2 from $40 = ?$    4 from $40 = ?$    6 from $40 = ?$
  7 from $40 = ?$    5 from $40 = ?$    9 from $40 = ?$
  8 from $40 = ?$    3 from $40 = ?$   10 from $40 = ?$

Add squares, a few at a time, to the figure on the board and let the children count and combine them. As each column is completed, number the last square. Continue this work from day to day until the figure of 100 squares is completed.

# CHAPTER II

## TENS

### Cents and Dimes, Addition and Subtraction, Tens and Units, Roman Numeral X

The questions upon the table which immediately follow it are designed to lead the children to analyze it as an object of vision without reference to its symbolism. Similar questions should be given a few minutes every day until the children are familiar with the relative positions of the numbers.

### NUMBER TABLE*

| 1 | 11 | 21 | 31 | 41 | 51 | 61 | 71 | 81 | 91 |
|---|----|----|----|----|----|----|----|----|----|
| 2 | 12 | 22 | 32 | 42 | 52 | 62 | 72 | 82 | 92 |
| 3 | 13 | 23 | 33 | 43 | 53 | 63 | 73 | 83 | 93 |
| 4 | 14 | 24 | 34 | 44 | 54 | 64 | 74 | 84 | 94 |
| 5 | 15 | 25 | 35 | 45 | 55 | 65 | 75 | 85 | 95 |
| 6 | 16 | 26 | 36 | 46 | 56 | 66 | 76 | 86 | 96 |
| 7 | 17 | 27 | 37 | 47 | 57 | 67 | 77 | 87 | 97 |
| 8 | 18 | 28 | 38 | 48 | 58 | 68 | 78 | 88 | 98 |
| 9 | 19 | 29 | 39 | 49 | 59 | 69 | 79 | 89 | 99 |
| 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |

* The number table should be written in large figures upon the board, or a chart should be made of it. The figures may be drawn with charcoal upon manila paper, or painted upon shade cloth.

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1. How many columns of numbers in this table?

2. How many numbers in each column?

3. Point out and name the first ten numbers.

4. Point out and name the second ten numbers. The fourth ten.

5. Show the tenth (or last) ten numbers. The ninth ten. The third ten.

6. What is the first number of the second ten? Of the third ten? Of the tenth ten? Of the fifth ten?

7. What is the last number of the first ten? Of the third ten? Of the fourth ten? Of the second ten? Of the ninth ten?

8. What is the last number of the tenth ten?

9. How many numbers are there in the whole table?

10. Point out and name the second number of the first ten.

11. What is the second number of the second ten? Of the fourth ten? Of the tenth ten?

12. Show the second number in each ten, and tell what figure it ends with.

13. Point out and name the third number of each ten, and tell what figure it ends with.

Let children point out the corresponding numbers in each ten until they see their regular decimal succession.

14. In the table of numbers, which number is written just above the number 4? Just above the number 14? 24? 44?

15. Which one is written just below the number 14? Just below 24? 34?

16. Find 35 and show what number is written just at the right of it. At the left of it.

**17.** What number is written just at the right of 41? At the left of it?

**18.** Begin at the number 8 and read toward the right, naming every number.

**19.** Begin with number 3, and read until you reach 93.

**20.** Begin with number 97, and read to the left until you reach 7.

**21.** In which column do you find the number 25? 48? 67? 94? 79?

**22.** 40 is at the end of which column? Where is 80?

**23.** Look at the last number of all the columns and tell what figure each number ends with.

**24.** Name the next to the last number of each column. What figure is the same in each?

**25.** Name all the numbers in the table that end in 7. In 5. In 3. In 8.

**26.** 21 is at the beginning of which column? Where is 51? 71? 91?

**27.** Name all the numbers in the table that end in 4.

**28.** Point out the 12th number. The 22d. The 32d. The 42d. The 16th. The 26th. The 36th. The 46th. The 56th.

**29.** How many numbers in the first two tens?

**30.** 10 numbers and 10 numbers are how many numbers?

**31.** 20 and 10 are how many?

**32.** 30 and 10 are how many?

**33.** 30 and 10 = how many?   50 and 10 = how many? 60 and 10 = how many?   70 + 10 = ?   90 + 10 = ?

The teacher should provide herself with actual money, consisting of dimes and cents, with which to illustrate the following work. Give much oral work. Let the children make problems for the class to solve. It will be seen that in this work the child's attention is drawn to the facts of number, and not yet to the processes of addition and subtraction.

**34.** How many cents equal a dime? What else are dimes called? *Ans.* Ten-cent pieces.

**35.** How many cents equal two dimes? Three dimes? Four dimes?

**36.** If you had 20 cents, how many dimes would you have?

**37.** If you had 30 cents, how many dimes would you have?

**38.** 40 cents equal how many dimes?

**39.** Which is the more money, 31 cents or three dimes? How much more?

**40.** If you had 10 cents and your father gave you 10 cents more, how many cents would you have? How many dimes would they equal?

**41.** If you had 20 cents and your father gave you 10 cents more, how much money would you have?

**42.** If you had 30 cents and your brother gave you 10 cents more, how much money would you have?

**43.** If you had 20 cents and gave away 10 cents, how many cents would you have left?

**44.** If you had 30 cents and lost 10 cents, how much money would you have?

**45.** If you had 10 cents and your mother gave you a ten-cent piece, how much money would you have?

**46.** If you had a dime and your mother gave you 10 cents, how many cents' worth of apples could you buy with your money?

**47.** How many tens make 20? Point them out in the table.

**48.** Show how many tens make 30. 40. 60. 80. 50. 90.

**49.** Sixty means six tens; what does seventy mean? Eighty? Ninety?

**50.** When we mean three tens, we do not say threety; what do we say?

**51.** How do we express two tens? Four tens? Five tens? Ten tens?

**52.** Can you find out how many tens make 50 without counting them?

**53.** If you have 10 cents and your brother has 11 cents, how many more has he than you have?

**54.** If you have 10 cents and your sister has 2 cents more than you, how many cents has she?

**55.** 10 cents and 3 cents equal how many cents?

**56.** One dime and 5 cents equal how many cents?

**57.** One dime and 7 cents equal how many cents?

**58.** One dime and 6 cents equal how many cents?

**59.** One dime and 8 cents equal how many cents?

**60.** Find 10 in the table, add 4, and point out the number which is the answer. In the same way add 9 to 10.

**61.** Add 7 to 10. Add 6 to 10. 5 to 10. 3 to 10. 8 to 10.

**62.** $10 + 2 = ?$  $10 + 9 = ?$  $10 + 4 = ?$

**63.** Find 20 in the table, add 3, and point out the number which is the answer.

**64.** In the same way add 6 to 20. Add 4 to 20. Add 7 to 20. Add 9 to 20.

**65.** $20 + 5 = ?$ $20 + 2 = ?$ $20 + 8?$ $20 + 4 = ?$

**66.** If you have two dimes and one cent, how many cents in money have you?

**67.** If you have 2 dimes and three cents, how much money have you?

How many cents are equal to:

**68.** 2 dimes and 5 cents?

**69.** 2 dimes and 4 cents?

**70.** 20 cents lacking 1 cent?

**71.** 20 cents lacking 2 cents?

**72.** 2 dimes and 7 cents?

**73.** 2 dimes and 9 cents?

**74.** 20 cents lacking 3 cents?

**75.** 20 cents lacking 4 cents?

**76.** Find 30, add 4, and point out the answer. Add 3 to 30 in the same way.

**77.** Add 5 to 30. 7 to 30. 2 to 30. 8 to 30. 6 to 30. 9 to 30.

**78.** Three dimes = how many cents?

**79.** If you have 3 dimes and 2 cents, how many cents in money have you?

**80.** If you have 3 dimes and 4 cents, how much money have you?

How many cents are equal to:

**81.** 3 dimes and 3 cents?

**82.** 3 dimes and 7 cents?

**83.** 30 cents less 1 cent = ?

**84.** 30 cents less 3 cents = ?

**85.** 3 dimes and 5 cents?

**86.** 3 dimes and 9 cents?

**87.** 30 cents less 4 cents = ?

**88.** 30 cents less 2 cents = ?

**89.** 11 cents equal how many dimes and how many cents over ?

**90.** How much more than a dime are 13 cents ? 15 cents ? 17 cents ? 14 cents ? 19 cents ?

**91.** How much more than 2 dimes are 21 cents ? 24 cents ? 22 cents ?

**92.** How much more than 3 dimes are 33 cents ? 31 cents ? 37 cents ?

**93.** If you buy something for 9 cents and give the clerk a dime, how much change ought you to have ?

**94.** If you buy something which costs 29 cents and give the clerk 3 dimes, how much change should you have ?

**95.** If you buy something that costs 18 cents and give the clerk 2 dimes, how much change ought you to have ?

**96.** If James had 3 cents more he would have 10 cents. How much money has he ?

**97.** John has a dime, a nickel, and 2 cents. How much money has he ? Walter has 2 dimes. How much more has he than John ?

**98.** Henry has 2 dimes, a nickel, and 3 cents. How much more money must he get to have 30 cents ?

**99.** Mary has 3 dimes. If her mother should give her 9 cents, how much money would she have ? How much more must she get to buy something worth 41 cents ?

**100.** John has 3 dimes, and James has 7 cents. How many cents have they both ?

**101.** Find 40 in the table, add 5, and point out the answer.

**102.** Add 8 to 20. Add 4 to 20. Add 3 to 30. Add 7 to 30. Add 2 to 40.

**103.** Add 8 to 40. Add 3 to 50. Add 8 to 50. Add 4 to 60. Add 6 to 60.

**104.** Add 3 to 70. Add 9 to 70. Add 5 to 80. Add 7 to 80. Add 1 to 90.

Show the children how older people write numbers when they add them, and let them furnish numbers for many examples similar to the following. It will be observed that of the numbers combined, one is a multiple of 10, and the other a number less than 10.

**105.**

| To 10 | To 10 | To 10 | To 20 |
|---|---|---|---|
| add 3 | add 5 | add 7 | add 4 |
| 13 *Ans.* | *Ans.* | *Ans.* | *Ans.* |

| To 20 | To 30 | To 40 | To 50 |
|---|---|---|---|
| add 6 | add 3 | add 2 | add 4 |
| *Ans.* | *Ans.* | *Ans.* | *Ans.* |

| To 60 | To 70 | To 80 | To 90 |
|---|---|---|---|
| add 3 | add 6 | add 2 | add 5 |
| *Ans.* | *Ans.* | *Ans.* | *Ans.* |

**106.** If you divide 20 cents between two girls so that each gets the same, how much will each get? How much is one half of 20?

**107.** How many dimes are one half of 4 dimes?

**108.** If you divide 40 cents equally between two boys, how much will each get?

**109.** Three girls have 10 cents apiece. How much have they all together?

**110.** Mary had 20 cents, and Kate had 10 cents. How much did they both have?

**111.** Anna had 3 dimes, and Lucy had 10 cents. How many cents' worth of oranges could they buy with all their money?

**112.** Helen had 40 cents, and her mother gave her 10 cents. How much money had she then? She bought a doll for 49 cents. How much money had she left?

**113.** How many cents make a dollar? How many cents make half a dollar?

**114.** Which is the more money, 53 cents or half a dollar? How much more?

**115.** Find 30 in the table, add 10, and show the answer.

**116.** Add 10 to 50. Add 10 to 70. Add 10 to 40. Add 10 to 80. Add 10 to 90.

**117.**

| To 20 | To 40 | To 80 | To 60 | To 50 |
|-------|-------|-------|-------|-------|
| add 10 | add 10 | add 10 | add 10 | add 10 |

**118.** Begin at 10 and count by tens to 100.

**119.** Fill out and learn the following :

| | |
|---|---|
| 1 ten  = | 6 tens = |
| 2 tens = | 7 tens = |
| 3 tens = | 8 tens = |
| 4 tens = | 9 tens = |
| 5 tens = | 10 tens = |

**120.** 10, 20, 30, etc., are called multiples of 10. Begin with 10 and name the multiples of 10 as far as you can.

"Multiple" is not a difficult word for children when it is used in its objective sense, as in this case. The author's pupils used to call the multiples "bright numbers" until experience showed the advantage of giving them the true name.

**121.** What is the first multiple of 10? *Ans.* 10.

**122.** What is the second multiple of 10?

**123.** Point out the third multiple of 10.

**124.** What is the fourth multiple of 10? The seventh multiple of 10? The tenth multiple of 10?

**125.** What figure does each of the multiples of 10 end with?

**126.** 30 is which multiple of 10? 50 is which multiple of 10? 70 is which multiple of 10?

**127.** How many tens in 70? In 60? In 40? In 90?

**128.** 80 equals how many tens? 50 equals how many tens? 70 equals how many tens? 100 equals how many tens?

**129.** Write the table of numbers, setting them in straight columns, and making the multiples of 10 larger and brighter than the other numbers.

Let the children use colored crayons to make the multiples distinct. Give a few of the most expert pupils a certain space at the board where they can spend some time each day making their tables, until they consider them fit to be presented as their completed work. As each one finishes his table, give the space to another child until all have written it. The necessities of the acts of construction make the mental picture distinct.

**130.**   3 tens + 4 = ?    7 tens + 7 = ?    8 tens + 6 = ?
           9 tens + 5 = ?    3 tens + 2 = ?    4 tens + 8 = ?

Give occasionally chart exercises similar to the following:
Point out 5, add 4, add 2, take away 1, add 7, take away 3, add 5, subtract 1, etc. Have the children make the combinations without counting as soon as possible. Encourage them to recite without looking at the number table, but do not allow guessing. Require them to go back to the number table whenever they show indefinite ideas of numerical distances.

**131.** Cover up the last two numbers of the first ten in your number table. How many numbers of that column are left in sight?

**132.** If we cover the last two numbers of the first twenty, how many of the twenty are left?

**133.** Take 4 from 30 in the same way and show how many are left.

**134.** Take 2 from 70. 3 from 80. 4 from 90. 3 from 100.

**135.** Which is more, 2 tens or 19 ? How much more ?

**136.** Which is more, 3 tens or 28 ? How much more ?

**137.** 4 tens are how many more than 39 ? Than 37 ? Than 33 ? Than 31 ?

**138.** 62 is how many more than 6 tens ?

**139.** 83 is how many more than 8 tens ?

**140.** What number is 2 more than 28 ? 2 more than 38 ? Than 48 ? Than 78 ?

**141.** What number is 3 more than 10 ? 3 more than 20 ? Than 30 ? Than 80 ?

**142.** What number is 3 less than 10 ? 3 less than 40 ? Than 50 ? Than 60 ? Than 80 ?

**143.** What number is 4 more than 3 tens ? 4 more than 6 tens ? Than 5 tens ? Than 7 tens ? Than 9 tens ?

**144.** What must be added to 79 to equal 8 tens ?

**145.** How many must be added to 48 to equal 5 tens ?

**146.** How many must be added to 7 tens to make 72 ?

**147.** How many must be added to 3 tens to make 35 ?

**148.** How many must be taken from 4 tens to leave 38 ?

**149.** How many must be taken from 5 tens to leave 47 ?

**150.** How many must be subtracted from 95 to leave 9 tens ?

**151.** How many must be subtracted from 28 to leave 2 tens ?

**152.** John had 40 cents and lost 2 cents. How many had he left?

**153.** Mary has 10 cents. Anna has 3 times as many. How many has Anna?

Let the children make story problems like the preceding.

**154.**   $5 + 4 = ?$   $15 + 4 = ?$   $25 + 4 = ?$   $35 + 4 = ?$
   $55 + 4 = ?$   $65 + 4 = ?$   $75 + 4 = ?$   $85 + 4 = ?$

**155.** Add 3 to several numbers that end in 5, and point out the answers.

**156.** Add:

| 16 | 26 | 36 | 46 | 56 | 66 | 76 | 86 | 96 |
|----|----|----|----|----|----|----|----|----|
| 3  | 3  | 3  | 3  | 3  | 3  | 3  | 3  | 3  |

Will not some of the pupils find out for themselves that the additions can be performed easily by adding the units and bringing down the tens? This should be shown to all.

**157.** Add 4 to several numbers that end in 2. Write the numbers as grown people write large numbers when they add them.

**158.** Add 5 to some numbers that end in 3.

**159.** Add 2 to numbers that end in 7. Add 4 to numbers that end in 1.

Give oral as well as written work on these combinations until they are mastered and the children no longer count.

Observe that the sum of the units given in this work is less than 10.

**160.** Add:

| 46 | 33 | 23 | 51 | 71 | 84 | 62 | 66 | 41 |
|----|----|----|----|----|----|----|----|----|
| 2  | 6  | 4  | 7  | 8  | 3  | 5  | 3  | 5  |

**161.** If you had a figure made of 13 squares and should add 5 squares, how many squares would there be in the figure?

If the children are uncertain, let the squares be placed, not otherwise.

**162.** If you had 36 cents and earned 3 cents, how many would you have?

**163.** Mary had 23 nuts and picked up 4 nuts; how many had she then ?

Let the children make story problems.

**164.** Take 2 from 7.   2 from 17.   2 from 27.   2 from 37.   2 from 47.   2 from 57.

**165.** Take 2 from all the numbers on the number table that end in 8.   Point out the answers.

**166.** In the same way take 2 from all the numbers on the number table that end in 5.

**167.** From 39    Show that instead of thinking of the whole
     take  2    39 we can take 2 from 9 separately, and bring
            down the 3 tens.

| 59 | 29 | 49 | 79 | 99 | 69 | 89 |
|----|----|----|----|----|----|----|
| 2  | 2  | 2  | 2  | 2  | 2  | 2  |

**168.** Write some numbers that end in 6, and take 3 from each of them.

**169.** Take 3 from numbers that end in 9.

**170.** Take 4 from numbers that end in 8.

**171.** Take 4 from numbers that end in 6.

**172.** Take 5 from numbers that end in 9.

**173.** Take 5 from numbers that end in 7.

**174.** Take 8 from numbers that end in 9.

**175.** From 27   38   46   88   96   84   67   78   89
     take  2   3   4   3   5   3   5   4   3

**176.** If you had placed 27 squares in a figure and should take away 5 squares, how many would be left ?

**177.** If there were 38 squares in a figure and you took away 4 squares, how many would be left ?

**178.** John had 17 marbles and lost 4 marbles.  How many were left ?

**179.** Mr. Smith earns 28 dollars a week and spends 7 dollars for board. How much has he left?

**180.** Mary had 89 cents and spent 6 cents. How many had she left?

Call for similar number stories.

**181.** Point out 6, add 10, and point out the answer. Add 10 to 26. To 36. Go on adding tens until you reach 96.

**182.** In the same way add tens to 5 until you reach 95.

**183.** Mary may name a small number and the others may add tens to it.

It is to be hoped that some of the children will go beyond the limits of the 100, and that the others will readily follow.

**184.**

| To 35 | 64 | 86 | 48 | 57 | 33 | 72 |
|---|---|---|---|---|---|---|
| add 10 | 10 | 10 | 10 | 10 | 10 | 10 |

Call attention to the convenience of the plan of adding the columns of units and tens separately, and let the children prove by trial that it gives the same result as reckoning on the number table.

**185.** If you had 13 squares in a figure and added 10 squares, how many squares would there be in the figure?

**186.** 27 squares and 10 squares = how many squares?

**187.** If you had 24 cents and earned 10 cents, how much money would you have?

**188.** 10 cents added to a nickel = how many cents?

**189.** 10 cents added to a quarter of a dollar = how many cents?

**190.** Point out 48, and subtract 10. Take 10 from 38. From 28. From 18.

**191.** Subtract all the tens you can from 93. From 97. From 95. From 91. From 94.

**192.** John may name a number, and the others may subtract from it as many tens as they can.

**193.** From 87    79    64    21    47    86    73
     take 10    10    10    10    10    10    10

**194.** If there were 19 squares in a figure, and we took away 10 squares, how many would be left?

**195.** 38 squares lacking 10 squares = how many squares?

**196.** If Anna had 25 cents, and lost 10 cents, how many would she have left?

**197.** If William's father had 35 dollars, and spent 10 dollars for William's suit of clothes, how many dollars would he have left?

**198.** 48 chickens were in a coop, and 10 chickens were sold. How many were left?

**199.** Add 2 tens to 21. 3 tens to 42. 4 tens to 54. 3 tens to 26. 4 tens to 38.

**200.** Name a number smaller than 50, and add 5 tens to it.

**201.** Name a number smaller than 30, and add 7 tens to it.

**202.** Name a number smaller than 40, and add 4 tens to it.

**203.** Name a number smaller than 20, and add 5 tens to it.

**204.** Add: 68    43    57    29    19    36
          30    40    30    40    80    50

**205.** Subtract 2 tens from 47. 3 tens from 83. 5 tens from 79.

**206.** Name a number larger than 50, and subtract 4 tens from it.

**207.** Name a number larger than 80, and subtract 7 tens from it.

**208.** Name a number larger than 40, and subtract 2 tens from it.

**209.** Name a number larger than 70, and subtract 5 tens from it.

**210.** From 79    66    85    73    89    98    54
        take 30    20    50    40    60    80    30

**211.** Find 17, add 10, add 20 to the result, subtract 10, add 30, add 20, subtract 30, add 10, subtract 20.

**212.** Find 93, subtract 10, subtract 20, subtract 10, add 20, subtract 20, add 10, subtract 20.

Give similar chart exercises frequently.

**213.** Find 25 and add 10, and then 1.

**214.** Find 23 and add 11.   Add 11 to 46.   Add 11 to 75.   To 81.   To 58.

Call the children's attention to the relative position of numbers in the diagram whose difference is 11.   Do not let them count 11, but add 10 and then 1.

**215.** Begin with 11 and add elevens until you reach 99.

**216.** Find a number greater than 12 and less than 16, and add 2 elevens to it.

**217.** Find a number greater than 23 and less than 26, and add 2 elevens to it.

**218.** Add 2 elevens to each of the numbers that are between 34 and 37.

**219.** Think of 12, and without counting, add 11 to it. Keep on adding elevens until you reach 100.

**220.** Think of a number greater than 21 and less than 25, and add 2 elevens to it,

**221.** Add 23    75    68    74    26    33    48    87
          11    11    11    11    11    11    11    11

**222.** Point out on the number table the number that means 2 elevens, and add elevens to it until you reach 44. How many elevens did you add?

**223.** Add 36       74       37       55       41       34
          22       22       22       22       22       22

**224.** If James had 11 cents and John had as many more, how many did they both have? How many dimes, and how many cents over would their money equal?

**225.** If James had 24 cents and John had 11 cents more than James, how many did John have? How many dimes and how many cents?

**226.** Mr. Smith paid 75 dollars for a horse and 11 dollars for a harness. How much did they both cost?

Call for story problems, using the number 11.

**227.** Find 59 and take away 11. Take 11 from 83. From 75. From 84. From 97. From 48.

**228.** From 68       43       84       65       48       76
         take 11       11       11       11       11       11

         From 35       66       84       29       77       98
         take 22       22       22       22       22       22

**229.** A man had 33 dollars and lost 11 dollars. How much had he left?

**230.** 24 apples less 11 apples = how many apples?

**231.** 36 squares less 11 squares = how many squares?

**232.** Find 25 on the chart, add 10, and then 2.

**233.** Add 12 to 24. Keep on adding twelves until you reach 96. Remember that 12 means 10 and 2.

**234.** Think of a number greater than 40 and less than 48, and add 12 to it.

**235.** Add 12 to each of the numbers greater than 20 and less than 26.

**236.** Think of a number between 31 and 34, and add 3 twelves to it.

**237.** Think of a number between 63 and 66, and add 2 twelves to it.

**238.** Add:

| 82 | 47 | 63 | 75 | 84 | 56 | 24 | 66 | 87 |
|----|----|----|----|----|----|----|----|----|
| 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

**239.** Write 12 under 76 and add them. Write 12 under 44 and add them.

**240.** If you had 12 cents and received 12 cents, how many cents would you have? If you gained another 12 cents, how many cents would you have? How many dimes, and how many cents over?

**241.** If you had 15 cents and gained 12 cents, how many cents would you have?

**242.** Point out on the number table the numbers that mean 2 twelves. 3 twelves. 4 twelves. 5 twelves. 6 twelves. 7 twelves.

**243.** Find the number that means 3 twelves; write it under 42 and add.

**244.** Write under 21 the number that means 4 twelves, and add.

**245.** Add 15 to the number that means 2 twelves.

**246.** Find 48, take 12 from it, and point out the number that is left. Keep on taking twelves until nothing is left.

**247.** Find 59 and take twelves from it until 11 remains.

**248.** From    88      96      34      78      25      57
        take    12      12      12      12      12      12
                ——      ——      ——      ——      ——      ——

**249.** Find 23 on the chart and add 13 to it.   Add 13 to 43.   To 53.

**250.** Add 14 to 23.   Add 14 to 33.   To 53.   To 73.

**251.** Add 15 to 24.   To 44.   To 74.   To 34.

**252.** Add 16 to 21.   To 31.   To 51.   To 81.   To 61.

**253.** Add 17 to 22.   To 82.   To 32.   To 52.

**254.** Add  22   31   84   24   25   85   81   33   24   51
             17   17   13   13   13   13   14   14   15   15
             ——   ——   ——   ——   ——   ——   ——   ——   ——   ——

**255.** From 77   86   47   62   48   55   78   69   58   53
         take 24   35   33   30   26   43   24   37   27   21
              ——   ——   ——   ——   ——   ——   ——   ——   ——   ——

**256.** How many children are there in your class?   If they were placed in groups of 10, how many groups would there be, and how many children over?

**257.** 12 cents = how many dimes and cents?

**258.** 18 cents = how many dimes and cents?

**259.** 33 cents = how many dimes and cents?

**260.** Write 32 cents in dimes and cents.

**261.** Write in dimes and cents 45 cents.   75 cents.   24 cents.   38 cents.

**262.** How many are 3 tens and 5?   7 tens and 6?   2 tens and 7?   4 tens and 3

**263.** How many ones in 4?   How many ones in 7?

**264.** Sometimes the word "unit" is used to mean one. How many units in 6?   In 9?

**265.** 11 means 1 ten and 1 unit.   What does 12 mean?
                              *Ans.* 1 ten and 2 units.

Take numbers consisting of tens and units, as 42, and lead the children to see that the figure 4 stands for 4 tens (which they may show by the number table, or by columns of squares), and that the figure 2 stands for the 2 remaining units.

**266.** What does 17 mean ? 21 ? 32 ? 64 ? 57 ? 63 ? 89 ?

**267.** Separate 37 into tens and units.

**268.** Separate into tens and units 48, 57, 65, 39, 82, 68, 95, 24.

**269.** How do you write 3 tens and 7 units together ? 5 tens and 2 units ?   7 tens and 8 units ?

**270.** In the number 25, which figure stands for tens ? Which figure stands for units ?

**271.** In the number 68, which figure is in the tens' place, and which is in the units' place ?

**272.** Write a number which has 4 in the tens' place and 7 in the units' place.

**273.** What number has 5 in the tens' place, and 3 in the units' place ?

**274.** Write some numbers of two places, and tell what figures you put in the tens' places, and what figure in the units' places.

**275.** Write a number which has 9 in the units' place. Can you write a number which has 10 in the units' place ?

**276.** When we mean 20 and 9, we write 29.   What do we write when we mean 20 and 10 ?  20 and 11 ?  20 and 12 ?

**277.**   To 32   add 64

4 units and 2 units = how many units ?
6 tens and 3 tens   = how many tens ?
How many tens and how many units in the answer ?

**278.** Write 52 under 46 and add them. Why is it best to write units under units, and tens under tens, when we add numbers?

**279.** Add 76 and 22. Add 23 and 34. Add 25 and 42. Add 31 and 63. Add 34 and 25. Add 11 and 78. Show how many tens and how many units in each answer.

**280.** Write 22 under 48, and subtract the smaller number from the greater.

**281.** From 39 take 11. From 27 take 15. From 78 take 22. From 66 take 21. From 83 take 62.

**282.** What is the largest number that is written with one figure?

**283.** What is the smallest number that is written with two figures?

**284.** What is the largest number that can be expressed by two figures?

**285.** What is the smallest number that can be expressed by three figures?

It should be explained that there were people living long ago, called Romans, who expressed numbers by letters instead of figures, and that sometimes we still use their notation.

**286.** X stands for 10 in Roman notation. Find the 10th chapter in this book, and tell on what page it begins. Make a 10 like that on the clock.

**287.** Since X stands for 10, what do two X's stand for? What do three X's stand for?

**288.** Write in Roman notation, 10, 20, 30.

# CHAPTER III

## TWOS

Even Numbers, Foot and Inch, Halves, Quart and Pint, Horizontal Line, Triangle, Thirds, Fourths, Vertical Line, Roman Numeral I

### NUMBER TABLE

| 1 | 11 | 21 | 31 | 41 | 51 | 61 | 71 | 81 | 91 |
|---|----|----|----|----|----|----|----|----|----|
| 2 | 12 | 22 | 32 | 42 | 52 | 62 | 72 | 82 | 92 |
| 3 | 13 | 23 | 33 | 43 | 53 | 63 | 73 | 83 | 93 |
| 4 | 14 | 24 | 34 | 44 | 54 | 64 | 74 | 84 | 94 |
| 5 | 15 | 25 | 35 | 45 | 55 | 65 | 75 | 85 | 95 |
| 6 | 16 | 26 | 36 | 46 | 56 | 66 | 76 | 86 | 96 |
| 7 | 17 | 27 | 37 | 47 | 57 | 67 | 77 | 87 | 97 |
| 8 | 18 | 28 | 38 | 48 | 58 | 68 | 78 | 88 | 98 |
| 9 | 19 | 29 | 39 | 49 | 59 | 69 | 79 | 89 | 99 |
| **10** | **20** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |

1. Begin with 2, and count by twos to 40, pointing out the numbers on the number table. Count without the number table.

**2.** These numbers that you have been giving, 2, 4, 6, 8, and so on, are called **Even Numbers.** Name all the even numbers in the 1st ten. In the 2d ten. In the 3d ten.

Call attention to the endings of the even numbers.

**3.** Name all the even numbers in the 10th ten. In the 9th ten. Tell how many tens and how many units in each even number in the 9th ten.

**4.** What is the smallest even number that you can think of?

**5.** Name all the even numbers that end in 2. In 4. In 8. In 0. What other figure may an even number have in its units' place besides 2, 4, 8 or 0?

**6.** What is the smallest even number in the 3d ten? In the 7th ten? In the 10th ten?

**7.** What is the largest even number in the 4th ten? In the 6th ten? In the 8th ten?

**8.** Think of the largest even number that is less than 29 and write it.

**9.** What is the next even number after 34? Before 34?

**10.** Find the third even number. The fifth even number.

**11.** What even number comes just before 49? How many tens and how many units in it?

A device for leading children to recognize even numbers is to write an even number out of the children's sight, and then let them guess what it is, giving them a clew, as " It is in the 3d ten " or " It ends with 4," or " It is between 91 and 99," " It is larger than 26, but not so large as 38." Sometimes allow the children to write the hidden number.

**12.** Write the first 30 numbers, marking them off into groups of two, as follows :

| | | |
|---|---|---|
| 1 | 11 | 21 |
| 2 | 12 | 22 |
| 3 | 13 | 23 |
| 4 | 14 | 24 |
| 5 | 15 | 25 |
| 6 | 16 | 26 |
| 7 | 17 | 27 |
| 8 | 18 | 28 |
| 9 | 19 | 29 |
| 10 | 20 | 30 |

**13.** How many groups of 2 equal 8? How many equal 12? 18? 14? 20? 16? 24? 30?

**14.** How many ones in 3 twos? In 5 twos? In 8 twos? In 6 twos? In 9 twos? In 12 twos? In 7 twos?

**15.** Name some even numbers, and tell how many twos they equal.

**16.** Fill out and learn the following :

| | | |
|---|---|---|
| 1 two  = | 5 twos = | 9 twos = |
| 2 twos = | 6 twos = | 10 twos = |
| 3 twos = | 7 twos = | 11 twos = |
| 4 twos = | 8 twos = | 12 twos = |

**17.** $54 + 2 = ?$    $84 + 2 = ?$    $94 + 2 = ?$    $74 + 2 = ?$

**18.** Find 42 in the number table, add 2 twos, and point out the answer.

**19.** Find 34, and add 3 twos.   Add 4 twos to 50.   Add 5 twos to 20.

**20.** Add 2 twos to 18.   Add 3 twos to 28.   Add 4 twos to 36.

**21.** Find 76, add 6 twos, and show the answer.   Add 7 twos to 64.   Add 8 twos to 24.   Add 9 twos to 20.

**22.** Point out even numbers and add some twos to them.

**23.** How many twos must be added to 12 to equal 18? To equal 22?   To equal 16?

**24.** How many twos must be added to 14 to equal 20? To equal 24? To equal 18?

**25.** If you had 18 cents and gained 2 cents, how many would you have? How many dimes would it equal?

**26.** If you had 16 cents, and your mother gave you 2 cents, and your father gave you 2 cents, how many cents would you have?

**27.** If you had 18 cents, and 3 people each gave you 2 cents, how many cents would you have?

**28.** If you had 10 cents, and 5 people each gave you 2 cents, how many cents would you have?

**29.** Add:

| 54 | 66 | 36 | 32 | 86 | 64 | 56 |
|----|----|----|----|----|----|----|
| 12 | 22 | 42 | 54 | 12 | 32 | 22 |

| 42 | 52 | 74 | 22 | 34 | 72 | 84 |
|----|----|----|----|----|----|----|
| 34 | 26 | 14 | 46 | 24 | 22 | 12 |

**30.** Beginning at 20, count backwards by twos.

**31.** 2 from 36 leaves how many? 2 from 48 leaves how many? 2 from 96? $18 - 2 = ?$ $28 - 2 = ?$ $78 - 2 = ?$

Give questions in subtraction similar to the addition drill in Ex. 18–24.

**32.** If you had 36 cents and lost 2 cents, how many would you have left?

**33.** If you had 24 cents and lost 2 cents, how many would you have left?

**34.** If you had 2 dimes and bought something for 2 cents, how much money would you have left?

**35.** If you had a dollar and lost 2 cents, how much would you have left?

**36.** If 20 children were at a party and 2 went home, how many would be left? How many would be left when 2 more went home? When 2 more went home?

**37.** If there were 22 children belonging in your class and 2 were absent, how many would be present? If 2 of those were dismissed, how many would be left?

**38.** Find 20 and show how many twos must be subtracted from it that 14 may be left.

**39.** How many twos must be subtracted from 22 to leave 16? To leave 12?

**40.** Beginning at 30, count backwards 2 twos. What number did you reach?

**41.** Beginning at 40, count backwards by twos until you reach 32. How many twos did you count off?

**42.** How many twos must be taken from 36 to leave 28? 24? 20?

**43.** If you had 40 cents and gave 2 cents to each of 4 boys, how many cents would you have left?

| **44.** From | 68 | 76 | 86 | 38 | 44 | 56 | 32 | 66 | 54 | 86 |
|---|---|---|---|---|---|---|---|---|---|---|
| take | 26 | 34 | 42 | 12 | 22 | 34 | 22 | 42 | 24 | 36 |

**45.** If you had 40 cents and each of 5 boys gave you 2 cents, how many cents would you have? How many dimes would they equal?

**46.** Draw with a foot rule a line a foot long, and mark off the inches. How many inches make a foot?

**47.** Draw a line 10 inches long, marking the inches. A 10-inch line lacks how many inches of being as long as a line a foot long? Show how many times a 2-inch line can be measured off on a 10-inch line.

**48.** Make the line that is a foot long, 2 inches longer. How long is it now ? How much longer is it than the 10-inch line ?

**49.** How many times can a 2-inch line be measured off on a 14-inch line ?

**50.** Lengthen the 14-inch line 2 inches, and tell how long it is. How many times will it contain a 2-inch line?

**51.** Lengthen the 16-inch line 2 inches and tell how long it is, and how many times it contains a 2-inch line.

**52.** Lengthen the 18-inch line 2 inches and tell how long it is and how many times it contains a 2-inch line.

**53.** 16 divided into groups of 2 = how many groups ?

**54.** 24 divided into groups of 2 = how many groups ?

**55.** $20 \div 2 = ?$

Show division as a process of separating the larger number into groups of the less. Illustrate by grouping objects, marks, or the numbers of the number table.

**56.**  $14 \div 2 = ?$   $22 \div 2 = ?$   $12 \div 2 = ?$   $18 \div 2 = ?$
   $20 \div 10 = ?$   $40 \div 10 = ?$   $70 \div 10 = ?$   $30 \div 10 = ?$

**57.** How many times can a 10-inch line be measured off on a 20-inch line ?

**58.** How long is a line which is one half as long as a 20-inch line ?

**59.** Cut a slip of paper 12 inches long, double it to find the middle, and tell how many inches long one half of the strip is.

**60.** Measure off a 14-inch line and find how many inches one half of it measures.

**61.** Fill out and learn the following :

| | |
|---|---|
| One half of   2 = ? | $\frac{1}{2}$ of 12 = ? |
| One half of   4 = ? | $\frac{1}{2}$ of 14 = ? |
| $\frac{1}{2}$ of   6 = ? | $\frac{1}{2}$ of 16 = ? |
| $\frac{1}{2}$ of   8 = ? | $\frac{1}{2}$ of 18 = ? |
| $\frac{1}{2}$ of 10 = ? | $\frac{1}{2}$ of 20 = ? |

**62.** Find 4 in the table, and point out the number which means one half of it.

**63.** Show 10 and the number which is $\frac{1}{2}$ of it.   Show $\frac{1}{2}$ of 12.   Of 16.   Of 20.   Of 14.   Of 18.

**64.** Mary has 14 cents, and Julia has $\frac{1}{2}$ as many.   How many has Julia ?

**65.** How many eggs in $\frac{1}{2}$ a dozen ?

**66.** When candy is 10 cents a pound, how many cents will $\frac{1}{2}$ a pound cost ?

**67.** When candy is 20 cents a pound, how much will $\frac{1}{2}$ a pound cost ?

**68.** How many pints make a quart ?

Let the children pour the water from pint measure to quart measure, and find out the fact for themselves.

**69.** How many pints in 2 quarts ?   In 4 quarts ?   In 6 quarts ?   In 7 quarts ?   In 9 quarts ?   In 3 quarts ?   In 8 quarts ?   In 12 quarts ?   In 5 quarts ?

**70.** If a bucket has 12 pints of water in it, how many quarts of water can be taken out of it ?

The child who cannot imagine the process should be allowed to work it out practically.

**71.** How many quarts in 12 pints ?   In 18 pints ?   In 14 pints ?   In 10 pints ?

**72.** A pint of milk equals what part of a quart ?

**73.** If a quart of milk costs 6 cents, how much does a pint cost?

**74.** If a quart of vinegar costs 8 cents, how much does a pint cost?

**75.** If a quart of molasses costs 18 cents, how much does a pint cost?

Teach the horizontal lines.

**76.** Draw a horizontal line 20 inches long. Into how many 2-inch lines can it be divided? A 12-inch line = how many 2-inch lines? A 16-inch line = how many 2-inch lines? An 18-inch line = how many 2-inch lines?

**77.** Seven 2-inch lines = how long a line? Eleven 2-inch lines? Twelve 2-inch lines?

**78.** 2 inches × 6 = ? This should be read: "2 inches multiplied by 6 = ?"

**79.** 2 inches × 7 = ?  2 inches × 9 = ?
2 inches × 12 = ?  2 inches × 10 = ?
2 inches × 4 = ?  2 inches × 8 = ?

**80.** What name is given to numbers which equal any number of twos?

**81.** Name all the even numbers between 11 and 19. Between 21 and 31.

**82.** Begin at 18 and name all the even numbers to 34.

**83.** How many even numbers are there less than 20? How many less than 26?

**84.** What even number is 3 more than 31? How many tens and how many units in it?

**85.** How many gloves in 7 pairs of gloves?

**86.** How many shoes in 9 pairs of shoes?

**87.** How many pints of milk in 8 quarts? In 10 quarts? In 11 quarts?

**88.** How many shoes can 5 boys wear at the same time?

**89.** 12 men paid 2 dollars apiece to hire a sailboat. How much did they all pay?

**90.** 11 boys put in 2 cents apiece to buy a ball. How much did they all put in?

**91.** How many wheels have 10 bicycles?

**92.** 7 chickens have how many feet?

**93.** How much will 11 two-cent postage stamps cost?

**94.** 8 pairs of horses = how many horses?

**95.** How many wings have 12 birds?

**96.** If you had 18 apples, to how many children could you give 2 apples apiece?

**97.** 20 children are going to march by couples. How many couples will there be? If there were 16 children, into how many couples could they be formed? $16 \div 2 = ?$ $14 \div 2 = ?$

**98.** If there were 13 children, into how many couples could they be formed? (Illustrate if necessary.)

**99.** Place inch-squares as in Fig. 1.

Push the squares apart so as to divide your figure into halves. How many square inches in the whole figure? How many in each half?
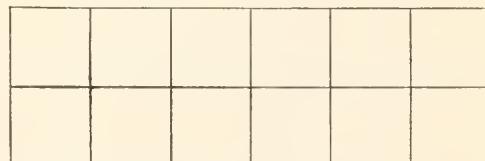


Fig. 1

After the children have made the figures, it would be well for the teacher to have them close their books and to give them the questions orally, developing ideas of forms and of the ratio of their parts as far as the abilities of each class allow.

**100.** Place inch-squares as in Fig. 2. Divide the figure into halves. How many squares in each half? Can you put the halves of Fig. 2 together so as to make Fig. 1?
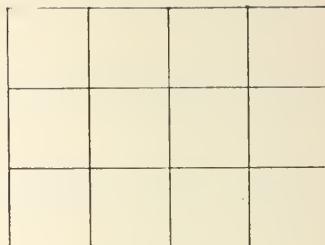


Fig. 2

**101.** Which is the larger, Fig. 1 or Fig. 2?

**102.** Place inch-squares as in Fig. 3. Divide the figure into halves, and tell how many square inches in each half. Can you put the halves of Fig. 3 together so as to make Fig. 2?
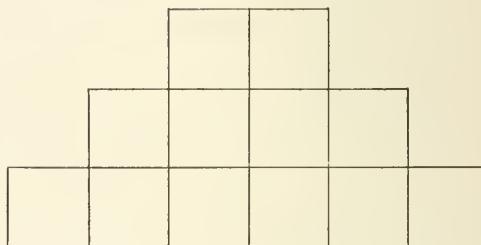


Fig. 3

**103.** Which is the largest, Fig. 1, Fig. 2, or Fig. 3? Show some horizontal lines in Fig. 3.

Let the children combine squares into figures of their own devising, divide the figures into halves, and report upon them. Encourage symmetrical forms.

**104.** Cut an inch-square in two so as to make triangles like these. 

**105.** Place the triangles as in Fig. 4. How many triangles would it take to make 6 such figures.



Fig. 4

**106.** Place other triangles as in Fig. 5. How many triangles would it take to make 9 figures like Fig. 5?



Fig. 5

**107.** Place others as in Fig. 6. How many triangles would you need to make 7 figures like Fig. 6?

**108.** Place others as in Fig. 7. Which is the largest of these figures?
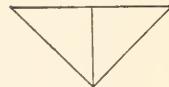
Let the children show the equality of the figures by rearranging each of them into a square.

**109.** Copy Fig. 8 by placing triangles. How many triangles does it take? How many inch squares does it take to make the triangles used in copying Fig. 8?
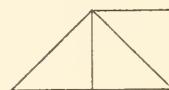
**110.** Make Fig. 9. Which is greater, Fig. 8 or Fig. 9? How many square inches in each? How many square inches in both?
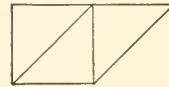
**111.** Place three triangles so as to make other figures, and show how many square inches in each of the figures.

**112.** How many such triangles can you make from one inch square? From 3 squares? From 7 squares? From 8 squares? From 9 squares? From 10 squares?

**113.** 12 such triangles = how many inch squares?

If the children are uncertain, let them work out the problem by arranging the 12 triangles into inch squares.

**114.** 14 such triangles = how many inch squares? 18 triangles = ? 20 triangles = ? 22 triangles = ? 24 triangles = ?

**115.** 10 = how many twos? 2 tens = how many twos? 2 tens = how many units? 10 twos = how many units?

**116.** 5 tens + 2 units = how many units?  6 tens + 4 units = how many units?

**117.** If Mary had 3 dimes and earned 8 cents, how much money would she have?

**118.** If John had 7 dimes and a nickel, how much money would he have?

Call for story problems.

**119.** What is an even number?

**120.** Name an even number smaller than 20, and tell how many twos it equals.
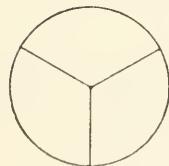
**121.** Into how many parts is this circle divided?

**122.** When anything is divided into three equal parts, what is each part called?

*Ans.* One third, written $\frac{1}{3}$.

Show $\frac{1}{3}$ of the circle.  Show $\frac{2}{3}$ of it.

**123.** Draw a line 3 inches long.  Mark off $\frac{1}{3}$ of it.

**124.** Cut a strip of paper 3 inches long and fold it into thirds.  Show $\frac{1}{3}$ of it.  Show $\frac{2}{3}$ of it.

**125.** Find Fig. 8, Ex. 109, and show how much $\frac{1}{3}$ of it is.  Show $\frac{2}{3}$ of it.

**126.** Show $\frac{2}{3}$ of Fig. 9, Ex. 110.  Show $\frac{1}{3}$ of Fig. 2, Ex. 100.

Let the children estimate $\frac{1}{3}$ of the length of a book or stick or some convenient object.  Cut a strip of paper as long as the object, and fold it into thirds to test the correctness of the estimates.

Provide a tumbler of cylindrical shape, and require a child to bring it to you $\frac{1}{3}$ full of water; $\frac{2}{3}$ full; $\frac{2}{3}$ empty; $\frac{1}{3}$ empty.

**127.** If you put $\frac{1}{3}$ of a stick into the ground, how much will be above ground?

**128.** The snow was so deep that it covered $\frac{2}{3}$ of a fence post. What part of the post was bare?

**129.** What is $\frac{1}{3}$ of 6 squares? $\frac{1}{3}$ of 9 squares = how many? (Illustrate.)

**130.** How much is $\frac{1}{3}$ of 3 cents? $\frac{2}{3}$ of 3 cents = how many?

**131.** Turn to the number table and show $\frac{1}{3}$ of 3. $\frac{1}{3}$ of 6. $\frac{1}{3}$ of 9. $\frac{1}{3}$ of 30.

If the children do not see these relations readily, do not let them memorize the statements of them, but postpone the subject.

**132.** Place triangles as in Fig. 10. How many triangles does it take? How many square inches do they equal?


FIG. 10

**133.** Place triangles as in Fig. 11 and Fig. 12. Which is the larger figure? How many triangles in both? How many square inches do they both equal?
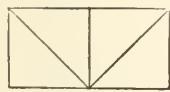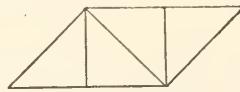

FIG. 11          FIG. 12

**134.** Place triangles as in Fig. 13, Fig. 14, and Fig. 15. Which is the largest figure? How many triangles in all? How many square inches do they all equal?
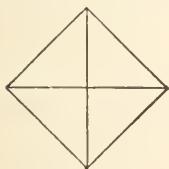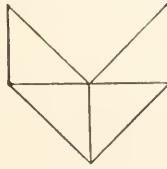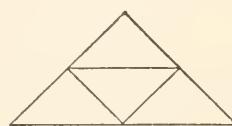

FIG. 13          FIG. 14          FIG. 15

**135.** Place 4 triangles so as to make a figure different from any in the book.

**136.** Fold a strip of paper into 4 equal parts. What is each part called? *Ans.* One fourth, written $\frac{1}{4}$.

**137.** Draw a picture of a pie cut into fourths. If $\frac{1}{4}$ were eaten, how many fourths would be left?

**138.** Take a piece of string and divide it into fourths.

**139.** If eight children made a class, how many children would $\frac{1}{4}$ of the class be? (Illustrate.)

**140.** Pour water into a glass until it is $\frac{1}{4}$ full.

**141.** Turn to Fig. 10, Ex. 132, and show $\frac{1}{4}$ of it. Show $\frac{2}{4}$. Show $\frac{3}{4}$.

**142.** Show $\frac{1}{4}$ of Fig. 11. Show $\frac{3}{4}$ of it.

**143.** Find Fig. 12, cover up $\frac{1}{4}$ of it, and tell how many fourths are in sight.

**144.** Draw a horizontal line 8 inches long and show $\frac{1}{4}$ of it. Show $\frac{2}{4}$ of it. Show $\frac{3}{4}$ of it.

**145.** A line in this position is called a vertical line. Hold your pencil up to show a vertical line.

**146.** Draw a vertical line 4 inches long, divide it into fourths, and show $\frac{1}{4}$ of it. Show $\frac{2}{4}$ of it. Show $\frac{3}{4}$ of it.

**147.** Turn to the number table and show $\frac{1}{4}$ of 4. $\frac{1}{4}$ of 8. $\frac{1}{4}$ of 40.

**148.** Take an inch square of paper and fold it into fourths shaped like those in Fig. 13. Fold an inch square into fourths of other shapes.

**149.** Draw a horizontal line 1 foot long and divide it into fourths. How many inches long is $\frac{1}{4}$ of a foot?

**150.** Draw a circle (by marking around a coin, tumbler, or some circular object), cut it out and fold it into fourths. How many fourths in the whole of anything?

**151.** Draw a horizontal line 9 inches long. Show $\frac{1}{3}$ of it. Show $\frac{2}{3}$ of it.

**152.** What is the sixth multiple of 10?

**153.** Write in order in a horizontal line all the multiples of 10 which you have learned from the number table. Are there any other multiples of 10? If so, write some.

**154.** Which will cost more, 6 pints of milk or 3 quarts? Explain.

**155.** 6 pints + 1 quart − 1 pint = how many pints?

**156.** 7 pints + 1 quart = how many pints?

**157.** 3 quarts + 2 pints = how many quarts?

**158.** 4 quarts − 1 pint = how many pints?

**159.** 3 dimes + 5 cents − 1 cent = how many cents?

**160.** 1 foot + 3 inches = how many inches?

**161.** Find some horizontal lines on this page.

**162.** What is the largest even number that can be written with one figure?

**163.** What is the largest even number that can be written with two figures?

**164.** What is the smallest even number that can be written with two figures?

**165.** How many thumbs do ten boys have?

**166.** How many toes do two boys have?

**167.** Which is more, 2 times 10 or 10 times 2?

**168.** What does X stand for in Roman notation? XX? XXX?

**169.** I stands for one. Find I on the clock. What does II mean on the clock? What does III mean?

**170.** Which chapter of this book are you studying? What is the number of the chapter before this?

**171.** $X + I =$ how many?        $XX + III = ?$

$X + II =$ how many?        $XXX + I = ?$

$X + III =$ how many?        $XXX + II = ?$

$XX + I =$ how many?        $XXX + III = ?$

**172.** Read XI from the clock. Read XII from the clock.

**173.** Read XIII. XXII. XXIII. XXXI. XXXII. XXXIII.

**174.** Write in Roman numbers 12, 32, 22, 13, 21, 31, 23, 33.

**175.** On which page of this book does the 11th chapter begin? The 13th chapter? The 12th chapter?

**176.** Add:

| 72 | 86 | 14 | 24 | 66 | 48 | 32 |
|----|----|----|----|----|----|----|
| 24 | 12 | 74 | 32 | 20 | 40 | 66 |

**177.** 

| From | 88 | 66 | 38 | 54 | 76 | 84 |
|------|----|----|----|----|----|----|
| take | 12 | 24 | 26 | 22 | 36 | 44 |

# CHAPTER IV

## ADDITION

Do not take up a new combination of numbers until the pupils are able to give promptly those already taken. Exercises in form, in simple fractions and measurements, and in Roman Numerals are introduced between the combinations not only to illustrate them, but to extend profitably the time during which they are learned.

**1.** Add: 43    How many units in the answer? How
       35    many tens?

**2.** Add: 73    How many units in the answer? How
       35    many tens? What do 10 tens make?

**3.** Add: 24  76  81  45  38  52  94  32  83
       81  33  27  62  71  53  13  73  25

Tell how many hundreds, how many tens, and how many units in each of the answers.

The learning of the addition combinations is a gradual process accomplished by many repeated perceptions on the part of the learner. Inexperienced teachers are cautioned not to be discouraged if the same pupil who has one day given the combinations correctly misses them at a later date. This merely shows that those paths in the undeveloped little brain need to be traversed again. Vary the work by having pupils place and count squares, make and count dots, or count objects, real or imaginary.

## NUMBER TABLE

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 11 | 21 | 31 | 41 | 51 | 61 | 71 | 81 | 91 |
| 2 | 12 | 22 | 32 | 42 | 52 | 62 | 72 | 82 | 92 |
| 3 | 13 | 23 | 33 | 43 | 53 | 63 | 73 | 83 | 93 |
| 4 | 14 | 24 | 34 | 44 | 54 | 64 | 74 | 84 | 94 |
| 5 | 15 | 25 | 35 | 45 | 55 | 65 | 75 | 85 | 95 |
| 6 | 16 | 26 | 36 | 46 | 56 | 66 | 76 | 86 | 96 |
| 7 | 17 | 27 | 37 | 47 | 57 | 67 | 77 | 87 | 97 |
| 8 | 18 | 28 | 38 | 48 | 58 | 68 | 78 | 88 | 98 |
| 9 | 19 | 29 | 39 | 49 | 59 | 69 | 79 | 89 | 99 |
| **10** | **20** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |

**4.** Find 9 on the number table and add 2. Add 2 to 19. Add 2 to: 29, 39, 49, 59, 69, 79, 89, 99.

Show 9 + 2 as 9 + 1, which completes the ten, and 1 more which makes 11.

Call attention to the relative position in the number table of 9 and 11, 19 and 21, etc., and train pupils to associate with them the thought of 2 as denoting the interval between them. Do this with each combination, noting the respective intervals.

**5.** 19 cents and 2 cents = how many cents? How many dimes and how many cents over?

**6.** Think of 9 little birds and of 3 more little birds coming to join them. Draw a picture of them.

**7.** 49 cents + 2 cents equal how many dimes and cents?

**8.** 99 cents and 2 cents = how many cents? How many dimes and cents? How much more than a dollar?

**9.** Add:

| 93 | 94 | 92 | 95 | 27 | 25 | 96 | 94 | 25 |
|---|---|---|---|---|---|---|---|---|
| 24 | 24 | 26 | 23 | 91 | 94 | 21 | 24 | 92 |

Tell how many hundreds, how many tens, and how many units in each of the answers.

**10.** How many must be added to 9 to equal 11 ?

**11.** How many must be taken from 11 to leave 9 ?

**12.** Show by the number table which is greater, $9 + 2$ or $2 + 9$.

**13.** Find each number in the number table that has 9 in the units' place, add 3 to it, and remember the result.

Show that in adding 3 to 9, 1 completes the first ten and the remaining 2 make 12.

**14.** Which is the greater, $9 + 3$ or $3 + 9$ ? Show it on the number table.

As each combination of units is taken up, lead the children to observe that the same result is obtained by combining the numbers in either order, and give drill upon the combinations stated in each way.

**15.** Add :

| 95 | 96 | 98 | 93 | 92 | 93 | 93 | 34 | 23 |
|----|----|----|----|----|----|----|----|----|
| 32 | 31 | 21 | 36 | 26 | 35 | 25 | 94 | 91 |

How many hundreds, how many tens, and how many units in the answers?

**16.** When numbers are added, the result is called their **Sum.** What is the sum of 29 and 3 ? 49 and 3 ? 89 and 3 ?

**17.** Jane had 19 cents and gained 3 cents. How many cents had she then ?

**18.** Louise paid 39 cents for a doll and 2 cents for a postage stamp. How much did both cost ?

**19.** John had 3 cents more than Thomas. Thomas had 29 cents. How much did John have?

**20.** 99 cents + 3 cents = how many cents ? How much more than a dollar ?

**21.** 9 pints + 3 pints = how many pints? How many quarts?

**22.** How many must be added to 9 to equal 12?

**23.** How many must be added to 29 to equal 32? 31?

**24.** 41 is how many more than 39?

**25.** How many must be taken from 52 to leave 49?

**26.** 9 cents are how many less than 11 cents? 12 cents?

At each lesson review combinations previously learned. Lead pupils to see that as 10 + 3 = 13, 9 + 3 must equal 1 less than 13, 9 + 4 must equal 1 less than 14, and so on.

**27.** Find 9 and add 4. Add 4 to 19. To 29. To 69.

**28.** What is the sum of 89 and 4? 69 and 2? 39 and 3?

**29.** Add:

| 93 | 96 | 98 | 40 | 37 | 43 | 95 | 97 | 92 | 97 |
|----|----|----|----|----|----|----|----|----|----|
| 42 | 32 | 41 | 99 | 92 | 92 | 33 | 41 | 40 | 22 |

**30.** Point out 9 on the number table, and without counting show the number that is 4 more than 9.

**31.** Show 29 and the number that is 4 more than 29.

**32.** Show 89 and the number that is 3 more than 89.

**33.** Name the number that is 2 more than 49.

**34.** Name quickly the number that is 4 more than 59.

**35.** Show 41 and the number that is 2 less than 41.

**36.** Show 53 and the number that is 4 less than 53.

**37.** Name the number that is 4 less than 13.

Drill pupils on the combinations until the mind furnishes instantly the correct result. Then apply the combinations to the facts of childish experience.

**38.** There were 29 apples in a basket and 4 apples were put in. How many apples were in the basket then?

**39.** Lucy had 19 squares on her desk and her teacher gave her 3 squares more. How many squares had she then?

**40.** William had 39 cents, and Alfred had 4 more than William. How many cents did Alfred have? How many dimes and how many cents over?

**41.** Add 5 to each of the numbers less than 100 that have 9 in the units' place, and learn the result.

**42.** Add: 98  92  33  94  99  54  47  93  31
         51  43  96  50  50  94  92  54  95

**43.** What is the sum of 29 and 5? 69 and 5? 39 and 3?

**44.** Show 79 and the number that is 5 more than 79.

**45.** Show 39 and the number that is 5 more than 39.

**46.** Name the number that is 5 more than 49.

**47.** Name the number that is 4 more than 89. Than 59.

**48.** Mary may name a number that ends in 9, and the rest may think of a number that is 5 more than hers. What number is 3 more than hers? 2 more? 4 more?

Make a general exercise of the work of Ex. 48. As new numbers are taken up use similar exercises.

**49.** Think of 74 and give the number that is 5 less than 74.

**50.** —— may give a number ending in 4, and the rest may give the number that is 5 less.

**51.** There were 29 people in a car, and 5 got on the car at the station. How many persons were in the car then?

**52.** There was a school of 39 children, and 4 new pupils were brought into it. How many pupils were in the school then?

**53.** Add 6 to 9, and to each of the numbers less than 100 that end in 9.

**54.** Add: 96  94  45  97  94  98  54  61  44  97
         53  65  91  62  35  61  93  95  92  50

**55.** Show 69 and the number that is 6 more than 69.

**56.** Show 49 and the number that is 6 more than 49; 4 more than 49; 2 more than 49; 5 more than 49; 3 more than 49.

**57.** Think of 79 and tell the number that is 6 more than 79; 3 more; 5 more; 2 more; 4 more.

See Ex. 48 and the note following.

**58.** What number is 6 more than 59? 2 more? 5 more? 3 more?

**59.** What number is 6 less than 75? 6 less than 95?

**60.** How many must be added to 49 to equal 55?

**61.** Six pupils of a school stayed at noon. The 39 other pupils went home to dinner. How many pupils were there in all?

**62.** What is the difference between 9 and 14? Between 19 and 25? 29 and 33? $69 + ? = 74$? $69 + ? = 72$? $69 + ? = 75$?

**63.** 33 cents are how many more than 29 cents?

**64.** Arthur found 19 eggs in one nest and 6 eggs in another. How many did he find in all?

**65.** Lizzie has 39 cents and needs 6 cents more to buy the doll she wants. What is the price of the doll?

**66.** Draw a line on the board 3 feet long. It is a yard long. We can call it either 1 yard or 3 feet.

Let the boys draw lines of various lengths on the floor, marking off the foot units and the yard units. Use them in working out the following, and refer to them whenever the children's imaginations fail to give the correct ideas of feet and yards.

**67.** How many feet in 3 yards? 4 yards? 2 yards? 6 yards? 5 yards? 8 yards?

**68.** How many yards in 6 feet? 12 feet? 9 feet? 15 feet? 18 feet? 21 feet? 27 feet? 30 feet?

**69.** 6 feet + 3 feet = how many feet? How many yards?

**70.** 9 feet + 3 feet = how many feet? How many yards?

**71.** How many yards in 12 feet + 3 feet? 15 feet + 3 feet?

**72.** How many feet in 1 yard + 1 foot? 2 yards + 2 feet?

**73.** How many feet in 4 yards + 1 foot? 3 yards + 2 feet?

**74.** 2 yards + 3 feet = how many yards?

**75.** 7 feet = how many yards and how many feet over?

**76.** How many yards and feet in 11 feet? 13 feet? 8 feet?

**77.** 9 feet + 4 feet = how many yards and feet?

**78.** How much do 9 feet + 5 feet lack of being 5 yards?

**79.** $(9 + 5) \div 2 = ?$ $(19 + 5) \div 2 = ?$ $(9 + 3) \div 2 = ?$

**80.** To each of the numbers less than 100 that have 9 in the units' place add 7.

**81.** What is the sum of 19 and 7? 39 and 7? 89 and 7?

**82.** Add:

| 93 | 98 | 91 | 45 | 96 | 97 | 93 | 91 |
|----|----|----|----|----|----|----|----|
| 74 | 61 | 72 | 93 | 52 | 62 | 74 | 38 |

Tell how many hundreds, how many tens, and how many units in each answer.

**83.** Write 91 and 73 and find their sum. $98 + 40 = ?$

**84.** Show 9 and the number that is 7 more than 9.

**85.** Show 89 and the number that is 7 more than 89.

**86.** Name the number that is 7 more than 49. 5 more; 3 more; 6 more; 2 more; 4 more.

**87.** What number is 7 less than 16? 7 less than 46? 7 less than 86? 5 less than 76? 4 less than 63?

**88.** What number must be added to 39 to equal 46?

**89.** There are 9 persons at home in Mr. Smith's family. When they have 7 visitors, how many persons are in the house?

**90.** 9 pints + 7 pints = how many quarts?

**91.** Thomas had 19 cents and his father gave him 7 cents. How many cents had he then?

**92.** 49 men were working on a building when 7 other men were hired to help. How many workmen were there in all?

**93.** Find each of the numbers that have 9 in the units' place and are less than 100, and add 8 to it.

**94.** 9 squares and 8 squares = how many squares?

**95.** Add :

| 93 | 95 | 87 | 86 | 92 | 95 | 24 | 96 |
|----|----|----|----|----|----|----|----|
| 86 | 84 | 91 | 93 | 74 | 43 | 91 | 81 |

**96.** Show 9 and the number that is 8 more than 9. 6 more than 9. 4 more than 9. 7 more than 9.

**97.** Think of 29. What number is 8 more? 5 more? 2 more? 7 more? 4 more?

**98.** —— may name a number ending in 9, and others may add to it numbers less than 9.

**99.** 19 books were on a shelf and 8 others were added. How many books were there then?

**100.** 89 persons were in a meeting. When 8 other persons came in, how many were present?

**101.** One cow gave 9 quarts of milk and another gave 8 quarts. How much milk did both cows give?

**102.** 9 ft. + 8 ft. = how many yd. and ft. ?

Contractions of denominations will be used hereafter interchangeably with the complete words.

**103.** Mary picked 9 pt. of berries and Anna picked 7 pt. How many pt. did both pick ? How many qt. ?

**104.** Add 9 to 9, and to each of the numbers less than 100 that end in 9.

**105.** Add:

| 95 | 98 | 94 | 97 | 93 | 49 | 93 | 92 |
|----|----|----|----|----|----|----|----|
| 93 | 91 | 35 | 92 | 94 | 90 | 64 | 87 |

**106.** Show on the number table 29 and the number that is 9 more than 29.

**107.** Show the number that is 9 more than 49. 9 more than 79. 9 more than 39. 8 more than 59. 7 more than 69. 6 more than 79. 5 more than 89. 4 more than 29.

**108.** 29 cents + 9 cents = how many cents ?

**109.** 99 cents + 9 cents = how much more than a dollar ?

**110.** Anna and Mary each picked 9 pt. of berries. How many qt. did both pick ?

**111.** How many sums did you find in working Ex. 95 ? How many in working Ex. 105 ? How many in both ?

BLACKBOARD EXERCISE.

Practice rapid adding of each figure on the edge of the square to the one in the middle. Then change 9 to 19, 29, 39, etc.

| 5 | 2 | 7 |
|---|---|---|
| 8 | 9 | 3 |
| 6 | 4 | 9 |

**112.** John has 9 marbles and James has 7 marbles. How many have both?

**113.** Make story problems in addition with 9 as one of your numbers.

**114.** Add: 72  96  93  92  45  93  68  92  95  64
            35  32  65  84  94  72  91  21  32  91

**115.** How many hundreds, how many tens, and how many units in the number 287? In 307? 422? 330? 976?

**116.** Write a number that has 3 hundreds, 8 tens, and 7 units.

**117.** Write a number made of 2 hundreds, 6 units, and 3 tens.

**118.** Write a number having 4 in the units' place, 6 in the tens' place, and 7 in the hundreds' place.

**119.** Write a number having 9 in the tens' place, 3 in the hundreds' place, and 4 in the units' place.

**120.** To 29 add 7.   It should be explained that of the 16 obtained by adding 9 and 7, the 6 units should be written in the units' place, and the ten should be combined with the 2 tens. The child should be led to see that the 36 obtained in this way is the same result as that which he got at first by counting.

**121.** Add: 49  89  69  69  39  49  29  59  69
              7   7   7  27  27  27  27  27  16

69    27    326    235    144    63    349    129
27    49    469    749    629    29    542    315

While the class are taking the form work and fractions which follow, keep the addition work clear in their minds by short drills and by giving examples like the preceding for seat work.

**122.** Fold an inch square of paper into 4 equal parts.

**123.** When anything is divided into 4 equal parts, what is each part called?

**124.** When anything is divided into 5 equal parts, what is each part called? *Ans.* $\frac{1}{5}$.

**125.** Place triangles as in Fig. 1. How many triangles does it take to copy Fig. 1?
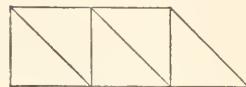
FIG. 1

**126.** Take away $\frac{1}{5}$ of your figure. How many fifths are left? Put back the $\frac{1}{5}$ and take away $\frac{2}{5}$. How many fifths are left?

**127.** Build Fig. 2 with triangles Show $\frac{1}{5}$ of Fig. 2. $\frac{2}{5}$ of it. $\frac{4}{5}$ of it.

FIG. 2

**128.** How many triangles did you use in building Fig. 2? How many square inches would they equal?

**129.** Build Fig. 3 with triangles. Which is larger, Fig. 2 or Fig. 3?

**130.** How many triangles did you use in making Fig. 3? How many square inches would they equal?
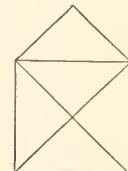
FIG. 3.

**131.** Can you take away one triangle from Fig. 3 so as to leave a large square?

**132.** Show $\frac{1}{5}$ of Fig. 3. Show $\frac{3}{5}$ of it and tell how many fifths are left. Show $\frac{4}{5}$ and what is left.

**133.** Put 5 triangles into a figure different from any in the book. Show $\frac{4}{5}$ of it; $\frac{2}{5}$ of it.

Let the pupils carry on the processes of building figures and parting, wholing, and parting them again as long as the exercise is interesting and instructive. If the quicker ones anticipate the work to come and show sixths, sevenths, and eighths, so much the better. The

presentations of the teacher and of the book must be in an orderly progression, but children should be encouraged to make their own discoveries freely.

**134.** Draw a vertical line 5 inches long. Mark it off into inches. Show $\frac{1}{5}$ of it. $\frac{3}{5}$. $\frac{4}{5}$. $\frac{2}{5}$.

**135.** Draw a horizontal line 10 inches long and show $\frac{1}{5}$ of it. Show $\frac{2}{5}$ of it. Show $\frac{4}{5}$ of it. Show $\frac{5}{5}$ of it.

1 inch

**136.** How many inches long is a line that is $\frac{1}{5}$ of 10 inches long? How long is $\frac{2}{5}$ of a 10-inch line? $\frac{3}{5}$ of a 10-inch line? $\frac{4}{5}$ of a 10-inch line?

**137.** 10 pupils may stand in a line. $\frac{1}{5}$ of them at this end of the line may step forward.

2 inches

Take places again. $\frac{2}{5}$ at the other end of the line may step forward. $\frac{2}{5}$ of 10 = how many? $\frac{3}{5}$ of 10 = how many?

**138.** Turn to the number table and show $\frac{1}{5}$ of 50. $\frac{2}{5}$ of 50. $\frac{3}{5}$ of 50. $\frac{4}{5}$ of 50. $\frac{1}{5}$ of 100.

**139.** Place triangles so as to make Fig. 4.

3 inches

How many square inches does it equal? How many triangles in Fig. 4? Separate it into halves. How many triangles in each half?

FIG. 4

4 inches

Put the halves together again.

**140.** When anything is divided into 6 equal parts, what is each part called?

**141.** Show $\frac{1}{6}$ of Fig. 4. $\frac{2}{6}$ of it. Show $\frac{3}{6}$ of it. Which is greater, $\frac{1}{6}$ or $\frac{1}{2}$? $\frac{1}{2}$ or $\frac{2}{6}$? $\frac{1}{2}$ or $\frac{3}{6}$?

**142.** $\frac{1}{6} + \frac{2}{6}$ = how many 6ths? $\frac{1}{6} + \frac{4}{6}$ = how

5 inches

many 6ths?
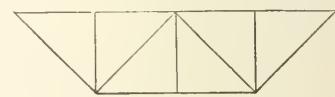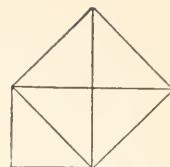
FIG. 5            FIG. 6            FIG. 7

**143.** Copy Figs. 5, 6, and 7 by placing triangles.

**144.** Can you take away two triangles from Fig. 5 so as to leave 2 square inches?

**145.** Can you take away two triangles from Fig. 6 so as to leave 2 square inches? Notice the triangles whose square corners are at the center of the figure.

**146.** Can you take away two triangles from Fig. 7 so as to leave a large square?

**147.** Can you take away two triangles from Fig. 7 so as to leave 2 square inches?

**148.** From Fig. 7 take away $\frac{1}{6}$, and show how many sixths are left.

**149.** How many sixths are left if you take away $\frac{2}{6}$? $\frac{3}{6}$?

**150.** $\frac{6}{6} - \frac{1}{6} =$ how many sixths? $\frac{6}{6} - \frac{4}{6} =$ how many sixths?

$\frac{6}{6} - \frac{3}{6} =$ how many sixths? $\frac{6}{6} - \frac{5}{6} =$ how many sixths?

**151.** Place triangles as in Fig. 8. Can you take away four triangles and leave 1 square inch?

**152.** Separate Fig. 8 into halves by taking away the lower row of triangles. How many sixths in each half?



FIG. 8

**153.** Place triangles as in Fig. 9. Separate the figure into three equal figures of the same shape. How many sixths in each third?
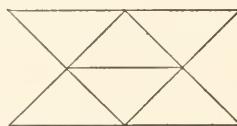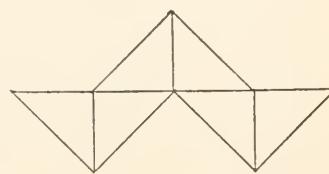


FIG. 9
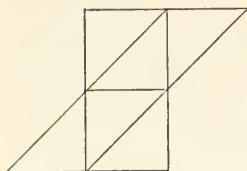
Fig. 10

**154.** Place triangles as in Fig. 10. Separate the figure into halves. $\frac{1}{2} = \frac{?}{6}$?

**155.** Place six triangles so as to make a different figure from any in the book, and divide it into halves.

**156.** Make a figure of six squares. Show $\frac{1}{6}$ of it. Show $\frac{2}{6}$ of it. Show $\frac{3}{6}$ or $\frac{1}{2}$ of it. Show $\frac{5}{6}$ of it.

**157.** Draw a vertical line 6 inches long. Show $\frac{1}{6}$ of it. Show $\frac{2}{6}$ of it. Show $\frac{3}{6}$ of it. What does $\frac{3}{6}$ of it equal?

**158.** Figure 11 is a rectangle. How many sides has it? How many corners? What kind of corners has it?
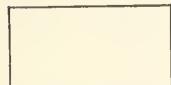


Fig. 11

Let pupils find rectangular surfaces, as window panes, blackboards, etc.

**159.** Draw a rectangle 6 inches long and 1 inch wide, and divide it into 6ths by vertical lines.

**160.** Draw a rectangle whose horizontal lines are each 5 inches long and vertical lines 1 inch long, and divide it into fifths.

**161.** Draw a rectangle 3 inches long and 2 inches wide, and divide it into 6ths.

**162.** Draw a picture of a pie cut into sixths.

**163.** Turn to the number table and show $\frac{1}{6}$ of 60. $\frac{2}{6}$ of 60. $\frac{4}{6}$ of 60. $\frac{5}{6}$ of 60.

**164.** Add:

| 226 | 433 | 659 | 649 | 377 | 739 | 429 | 349 |
|-----|-----|-----|-----|-----|-----|-----|-----|
| 319 | 529 | 124 | 332 | 519 | 249 | 535 | 618 |

**165.** Add: 437   How many hundreds, how many tens, 641   and how many units in the answer?

**166.** 10 hundreds make 1 thousand. Which place do the thousands have?

**167.** How many thousands, how many hundreds, how many tens, and how many units in the number 7654? 4326? 6304? 3829? 5340? 2002?

**168.** Write a number made of 5 units, 2 hundreds, 7 thousands, and 8 tens.

**169.** Write and read a number which has 5 in the fourth place, 8 in the third place, 3 in the second place, and 1 in the first place.

**170.** Write a number of 4 places and tell what is in each place.

**171.** Write 4351 under 5437 and add them. Why is it best to put units under units, tens under tens, hundreds under hundreds, and thousands under thousands?

**172.** Add:

| 3219 | 8647 | 7935 | 6396 | 3456 | 1639 |
|------|------|------|------|------|------|
| 1234 | 1239 | 1249 | 1272 | 1939 | 1924 |

**173.** Add 3 to 8, and add 3 to each of the numbers less than 100 that end in 8.

Show that in adding 3 to 8, 2 completes the first ten, and the remaining 1 makes 11.

**174.** Find the sum of 18 and 3. 48 and 3. 78 and 3.

**175.** Show on the number table the number that is 3 more than 8. 3 more than 28. 3 more than 88. 3 more than 58. 3 more than 38.

**176.** 8 ft. + 3 ft. = how many yd. and ft.?

**177.** 18 ft. + 3 ft. = how many yd.?

**178.** There were 38 sheep in a flock and 3 sheep were added to it. How many were there then?

**179.** John worked 28 examples on Monday, and on Tuesday he worked 3 more than on Monday. How many did he work on Tuesday?

**180.** Add: 325   1928   2878   2463   349   284   813
       819   633   913   928  815  631  358

**181.** Find the sum of 1328 and 2843.   4928 and 2953.

**182.** Find the sum of 80 and 30.   90 and 30.   90 and 50.

**183.** Find the sum of 8 and 4.   28 and 4.   38 and 4.
68 and 4.   88 and 4.   18 and 4.   58 and 4.

See suggestion after Ex. 173.

**184.** Show on the number table the number that is 4
more than 78.   4 more than 48.   4 more than 58.

**185.** Add:   827   869   1238   1835   1598   1318   823
       431  326  1323  1429  4123  4824  448

**186.** Mary found 38 peaches under one tree and 4
peaches under another.   How many peaches did she find
in all ?

**187.** James went to the grocery to buy sugar.   In
bringing it home he spilled 4 pounds.   He brought home
8 pounds.   How much did he buy ?

**188.** There were 28 pounds of butter in a jar and 4
pounds more were put into the jar.   How many were in
it then ?

**189.** Find the sum of 80 and 40.   90 and 40.   90 and 70.

**190.** 8 ft. + 4 ft. = how many yd.?

**191.** 8 pt. + 4 pt. = how many qt.?

**192.** How many quarts make a gallon ?

Let the children use quart and gallon measures and find out the
fact for themselves.

**193.** How many quarts make 2 gallons ?   3 gallons ?
4 gallons ?   5 gallons ?

**194.** How many quarts in 2 gallons and 1 quart ?   3 gal.
and 2 qt.?

**195.** There were 2 gal. and 3 qt. of molasses in a jug, and Mary used a quart of it to make candy. How many qt. were left?

**196.** How many gal. in 8 qt.? 12 qt.? 20 qt.? 16 qt.?

**197.** How many gal. and how many qt. over in 9 qt.? 11 qt.? 13 qt.? 15 qt.?

**198.** How many gal. in 8 qt. + 4 qt.? 9 qt. + 7 qt.?

**199.** 9 qt. less 1 qt. = how many gal.?

**200.** Add 5 to each of the numbers less than 100 whose unit figure is 8.

**201.** Find the sums :

| 873 | 729 | 8386 | 628 | 989 | 8359 | 648 | 933 | 445 |
|-----|-----|------|-----|-----|------|-----|-----|-----|
| 524 | 943 | 5353 | 843 | 250 | 1680 | 289 | 488 | 884 |

**202.** 8 ft. + 5 ft. = how many yd. and ft. ?

**203.** 58 lemons were in a box. If 5 more lemons were placed in the box, how many would it contain?

**204.** Mr. Smith set out 5 new trees in his orchard, which already had 88 trees. How many trees were there then?

**205.** A book cost 28 cents and a tablet cost 5 cents. How much did they both cost?

**206.** Find the sum of 80 and 50. 80 + 30. 90 + 90.

**207.** 8 qt. + 5 qt. = how many gal. and qt. ?

**208.** 2 gal. + 4 qt. = how many qt. ? How many gal. ?

**209.** If you drank a pint of milk every day, how many pints would you drink in 2 weeks? How many quarts?

**210.** Add 6 to some numbers that end in 8, and tell how many tens and how many units in each answer.

**211.** If you picked 8 apples from a tree and should pick off 6 more, how many would you have?

**212.** When John worked 18 problems in the morning and 6 in the afternoon, how many did he work in the whole day?

**213.** 8 ft. + 6 ft. = how much less than 5 yd.?

**214.** Find the sums :

| 846 | 3858 | 4888 | 3884 | 4898 | 8888 | 3618 |
|-----|------|------|------|------|------|------|
| 698 | 5596 | 4456 | 5659 | 9586 | 3456 | 4845 |

How many thousands, how many hundreds, how many tens, and how many units in each answer?

**215.** Write and read a number which means 1 thousand, 3 hundreds, 5 tens, 7 units.

**216.** Write a number that means 2 thousands, 5 hundreds, 0 tens, 4 units.

**217.** Write a number that is made of 11 thousands, 5 hundreds, 3 tens, 0 units.

**218.** Put 4 tens, 5 hundreds, 3 units into one number.

**219.** Put 6 units, 7 hundreds, 8 tens into one number.

**220.** Put 2 thousands, 1 unit, 6 tens, 4 hundreds into one number.

**221.** Put into one number 12 thousands, 2 units, 4 hundreds, 3 tens.

**222.** Put into one number 25 thousands, 4 tens, 1 hundred, 6 units.

**223.** 8 qt. + 6 qt. = how many gal. and qt. over?

**224.** Add 7 to several numbers whose unit figure is 8.

**225.** Harriet is 8 years old and Lucy is 7 years older. How old is Lucy?

**226.** A carriage cost 88 dollars, and a horse cost 7 dollars more than the carriage. How much did the horse cost?

**227.** 8 ft. and 7 ft. = how many yd. ?

**228.** Make problems using 7 and numbers that end in 8.

**229.** Add:

| 5898 | 3968 | 2897 | 5848 | 8989 | 25868 |
|------|------|------|------|------|-------|
| 9697 | 1497 | 3958 | 3697 | 4069 | 43036 |

**230.** What is the sum of 80 and 70? 80 and 60? 80 and 30? 80 and 40?

**231.** 8 qt. + 7 qt. = how many qt. ? How much less than 4 gal.?

**232.** Add 8 to some numbers whose unit figure is 8.

**233.** Anna has 2 dolls each of which cost 8 cents. How much did they both cost ?

**234.** Mr. Smith has 2 horses each of which cost 80 dollars. How much did they both cost ?

**235.** 8 qt. + 8 qt. = how many gal.?

**236.** 8 ft. + 8 ft. = how many yd. and ft.?

**237.** Find the sums :

| 867 | 2183 | 8482 | 8623 | 8623 | 6683 | 3468 | 9817 |
|-----|------|------|------|------|------|------|------|
| 832 | 9434 | 8351 | 8351 | 7986 | 8275 | 8522 | 6528 |

**238.** John drew a line 5 ft. long. How much over a yard was it in length ?

**239.** Samuel drew a line 8 ft. long and William drew one 3 yd. long. How much longer was William's line than Samuel's ?

**240.** Draw on the board a square 1 ft. long and 1 ft. wide. If you had a string long enough to lie all around on the line that bounds the square, how many ft. long would the string be ? How many yd. and how many ft. over ?

**241.** A rectangle is 2 ft. long and 1 ft. wide. Draw a small picture of the rectangle, and find how many ft. around it. How many yards?

See that the proportions of the " picture " are correct.

**242.** Draw a picture of a rectangle 3 ft. long and 1 ft. wide, and show how many ft. in the distance around it.

**243.** Draw a picture of a rectangle whose horizontal lines are 3 ft. long and whose vertical lines are 2 ft. long, and tell how far it is around it.

**244.** Add 9 to each number less than 101 whose unit figure is 8.

**245.** Show in what direction from 28 in the number table is the number that is 9 more than 28 ; 9 more than 38 ; 9 more than 48.

**246.** How much will a span of horses cost if one horse costs 80 dollars and the other 90 dollars ?

**247.** 8 qt. + 9 qt. = how many qt. more than 4 gal.?

**248.** 28 cents + 9 cents = how many dimes and cents ?

**249.** 8 ft. + 9 ft. = how many ft. less than 6 yd.?

**250.** Add:

| 2478 | 2348 | 8124 | 9825 | 8483 | 1628 |
|------|------|------|------|------|------|
| 8619 | 3798 | 7318 | 8938 | 9329 | 849 |

BLACKBOARD EXERCISE

| 6 | 9 | 4 |
|---|---|---|
| 3 | 8 | 7 |
| 5 | 8 | 2 |

Let each of the numbers on the edge of the square be added to the number in the middle. Then use 18, 28, etc., instead of 8. If the children cannot give any combination at sight, review it.

**251.** Find the largest even number that is less than 29 and add 7 to it.

**252.** Add 8 to the largest even number that is less than 49.

**253.** Five boys have how many toes? Nine boys have how many toes?

**254.** Give all the multiples of 10 that are less than 100.

**255.** Find the number that is 1 less than the third multiple of 10. Add 6 to it. Add 4 to it. Add 7 to it. Add 9 to it. Add 5 to it.

**256.** Find the number that is 2 less than the fifth multiple of 10 and add 9 to it. Add 3 to it. Add 7 to it. Add 4 to it. Add 8 to it.

**257.** 10 twos = ? Find the number that is 1 less than 10 twos and add 4 to it. Add 7 to it. Add 5 to it. Add 8 to it.

**258.** Draw a rectangle 5 in. long and 4 in. wide, and tell how far it is around it.

**259.** The line around a figure is called its **Perimeter.** Draw a rectangle 4 in. long and 3 in. wide, and tell how long its perimeter is.

**260.** How long is the perimeter of a rectangle which is 3 in. long and 3 in. wide? Draw.

Recall fractions previously learned.

**261.** Copy Fig. 12 by placing triangles. How many triangles in Fig. 12?

**262.** Show $\frac{1}{7}$ of the figure. Show $\frac{2}{7}$ of the figure. Show $\frac{3}{7}$ of it. How many remain? $\frac{2}{7} + \frac{3}{7} =$ how many sevenths? $\frac{5}{7} + \frac{2}{7} =$ how many sevenths?
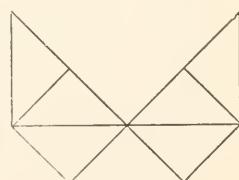
Fig. 12
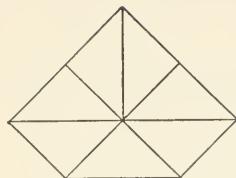
Fig. 13

**263.** Copy Fig. 13. How many triangles in the figure?

**264.** Take away $\frac{1}{7}$ of the figure and show how many sevenths remain. Take away $\frac{2}{7}$ and show how many sevenths remain. Take away $\frac{4}{7}$.

**265.** $\frac{7}{7} - \frac{1}{7} = \frac{?}{7}$    $\frac{6}{7} - \frac{4}{7} = \frac{?}{7}$    $\frac{4}{7} - \frac{2}{7} = \frac{?}{7}$    $\frac{2}{7} - \frac{2}{7} = \frac{?}{7}$

**266.** Place 7 triangles so as to make a figure different from those in the book, and show sevenths of it.

**267.** Draw a rectangle 7 in. long and 1 in. wide, and find the length of its perimeter.

**268.** $7 + 4 = ?$ Add 4 to each of the numbers in the number table whose unit figure is 7.

**269.** 17 cents + 4 cents = how many dimes and cents?

**270.** 70 cents + 40 cents = how many cents? How many dollars and dimes?

**271.** 7 qt. + 4 qt. = how many gal. and qt.?

**272.** John has 47 dollars and needs 4 dollars more to buy a bicycle. What is the price of the bicycle?

**273.** Add:

| 7425 | 7378 | 17849 | 8795 | 2135 | 8123 |
|------|------|-------|------|------|------|
| 4539 | 1839 | 29847 | 9249 | 1719 | 6427 |

**274.** Add 5 to each of the numbers in the number table whose unit figure is 7.

**275.** 7 cents + 5 cents = how many dimes and cents?

**276.** 70 cents + 50 cents = how many dollars and cents?

**277.** 7 pt. + 5 pt. = how many qt.? 7 ft. + 5 ft. = how many yd.?

**278.** A line 17 in. long was lengthened 5 in. How many ft. and in. long was it then?

**279.** 5 qt. of milk were poured into a can that already held 27 qt. of milk.  How many gal. were in the can then?

**280.** Add : 7642   1729   8757   9562   8967   3724
             5251   8449   5435   8737   7724   8573

**281.** Add 6 to each number smaller than 108 whose unit figure is 7.

**282.** $60+70=?$   $90+40=?$   $80+50=?$   $80+70=?$

**283.** Find the sum of 147 and 6.  327 and 6.  437 and 6.

**284.** John had 107 cents and gained 6 cents.  How many dollars, dimes, and cents had he then?

**285.** How many dollars, dimes, and cents in the sum of 207 cents + 6 cents?

**286.** 407 cents + 6 cents = ?   217 cents + 6 cents = ?

**287.** 427 cents + 6 cents = ?   967 cents + 6 cents = ?

**288.** Add : 3754   325   9626   8768   9387   272
             8927   947   947   1207   8904   9986

**289.** Add 7 to each number smaller than 108 whose unit figure is 7.

**290.** $70 + 70 = ?$   $80 + 80 = ?$   $90 + 90 = ?$

**291.** Find the sum of 187 and 7.  157 and 7.  277 and 7.

How many dollars, dimes, and cents in the sum of :

**292.** 314 cents + 7 cents?     **295.** 227 cents + 4 cents?

**293.** 287 cents + 7 cents?     **296.** 357 cents + 6 cents?

**294.** 537 cents + 7 cents?     **297.** 947 cents + 7 cents?

**298.** Name the days in the week.  How many days in 2 weeks?  3 weeks?

**299.** Mary made a visit of 17 days. Then her mother allowed her to stay a week longer. How many days in all did she stay?

**300.** 27 days + 1 week = how many days?

**301.** A line 7 ft. long was lengthened 7 ft. How much did it lack then of being 5 yd. long?

**302.** How wide is a square that is 7 in. long? Draw a square 7 in. long and find the length of its perimeter.

**303.** Mr. Smith is 27 years old, and Mr. Brown is 7 years older. How old is Mr. Brown?

**304.** Add: 2736   7826   4727   7268   50627   9773
              9729   7273   9737   7981    7197   6576

**305.** Add 8 to each number less than 118 whose unit figure is 7.

**306.** 70 + 80 = ?        70 + 50 = ?        70 + 60 = ?

**307.** Find the sum of 137 and 8.    267 + 8.    967 + 8.

**308.** 7 ft. + 8 ft. = how many yd.?

How many dollars, dimes, and cents in the sum of:

**309.** 547 cents + 8 cents?    **312.** 187 cents + 4 cents?
**310.** 627 cents + 8 cents?    **313.** 189 cents + 7 cents?
**311.** 917 cents + 8 cents?    **314.** 218 cents + 7 cents?

**315.** It is the custom to write 364 cents $3.64 and to call it 3 dollars and 64 cents. Read: $4.84; $9.87.

**316.** Add: $7.47   $8.27   $25.37   $48.47   $18.57
              2.38    1.48    97.28    23.27    25.36

**317.** The point which separates dollars and cents is called a **Decimal Point.** In writing columns of dollars and cents to be added or subtracted, why is it best to put the points in a vertical line?

**318.** Add 9 to each number that is less than 118 and has 7 in the units' place.

**319.** What is the sum of 127 and 9? 237 + 9? 487 + 9?

**320.** What is the sum of 70 and 90? 70 and 40?

**321.** $1.27 + 9 cents = ? $2.37 + 9 cents = ?

**322.** 7 qt. + 9 qt. = how many gal.?

**323.** 7 ft. + 9 ft. = how many yd. and ft.?

**324.** 7 pt. + 9 pt. = how many qt.? How many gal.?

**325.** Add: $4.57    $36.37    $15.77    $36.57    $18.97

           9.29      19.37      98.27      23.37      18.99

| 9 | 3 | 5 |
|---|---|---|
| 2 | 7 | 7 |
| 8 | 6 | 4 |

Practice sight addition of the numbers on the edge of the square to the number in the middle, and then substitute for 7 other numbers whose unit figure is 7.

**326.** What time is it when the hour hand of the clock is on V?

**327.** V stands for 5 in Roman notation. On what page does the 5th chapter of this book begin?

Show that two V's placed as follows $\underset{\Lambda}{V}$ make X or 10.

**328.** I written after V means I added to V, or 6. What does VII mean? VIII? Find the heading of the 6th chapter in this book. The 8th. The 7th.

Explain that when the smaller numeral is written after the greater their sum is to be found.

**329.** Read XX. XVI. XVII. XVIII. XXV. XXVI. XXVII. XXVIII. XXX. XXXV. XXXVII.

**330.** Write in Roman notation 15, 17, 23, 25, 28, 30.

**331.** Write in Roman notation the first even number in the second ten.

**332.** Write in Roman notation the number that is 7 more than the 3d multiple of 10.

**333.** Add 5 to several numbers whose unit figure is 6.

**334.** Find the sum of $186 + 5$.    $216 + 5$.    $296 + 5$.

**335.** Add: 

| $11.26 | $7.36 | $9.36 | $18.76 | $34.55 | $82.75 |
|--------|-------|-------|--------|--------|--------|
| 13.45 | 5.45 | 6.52 | 97.85 | 97.46 | 34.86 |

**336.** 6 qt. + 5 qt. = how many gal. and qt. ?

**337.** Write in Roman numbers the answers to the following : $6 + 5 =$?   $26 + 5 =$?   $36 + 5 =$?

**338.** 46 pupils were in a school and 5 new pupils entered. How many pupils were in the school then ?

**339.** Add: 

| 8653 | 84676 | 65745 | 36235 | 50685 | 60606 |
|------|-------|-------|-------|-------|-------|
| 7527 | 79515 | 96186 | 75486 | 64506 | 39545 |

How many thousands are there in each answer ?

**340.** Write a number that means 25 thousands, 3 hundreds, 5 tens, 7 units.

Write numbers made of :

**341.** 75 thousands, 7 hundreds, 0 tens, 4 units.

**342.** 131 thousands, 2 hundreds, 7 tens, 6 units.

**343.** 475 thousands, 3 hundreds, 8 tens, 0 units.

**344.** 187 thousands, 0 hundreds, 3 tens, 4 units.

**345.** Add 6 to each of ten numbers whose unit figure is 6.

**346.** Add: 

| 8466 | 19267 | 83646 | 96356 | 72685 | 96564 |
|------|-------|-------|-------|-------|-------|
| 7846 | 56762 | 47625 | 64925 | 66606 | 86165 |

**347.** 6 ft. + 6 ft. = how many yd. ?

**348.** 6 qt. + 6 qt. = how many gal. ?

**349.** 6 pt. + 6 pt. = how many qt. ?   How many gal. ?

**350.** 326 + 6 = ?   586 + 6 = ?   916 + 6 = ?   471 + 6 = ?

**351.** A man paid $60 for a horse and twice as much for his carriage.   How much did the carriage cost?

**352.** Add : $13.76   $24.96   $18.06   $28.76   $128.16
2.86   3.36   1.05   17.06   25.06

**353.** Copy Fig. 14 by placing inch-squares.  Find the length of the perimeter of the figure you have made.  If each inch line were a foot line, how many yards long would the perimeter be ?
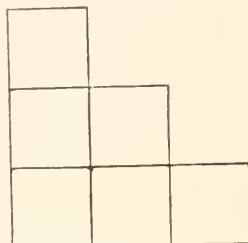
FIG. 14

**354.** Copy Fig. 15 by placing squares.  Find the length of the perimeter.  How many yards long would the perimeter be if each of the inch lines were changed to a foot line ?

**355.** Add 7 to each of ten numbers that have 6 for the unit figure.

**356.** Find the sum of 60 and 70.   60 + 50.   436 + 7.   596 + 7.
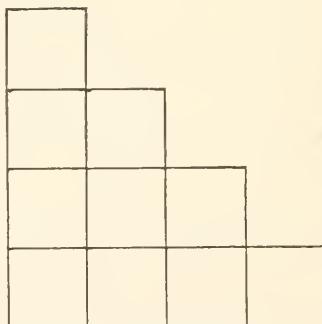
FIG. 15

**357.** Add :   $252.75   $187.36   $432.66   $314.86
964.27   187.17   719.57   938.97

**358.** 6 qt. + 7 qt. = how many gal. and qt.?

**359.** 6 ft. + 7 ft. = how many yd. and ft.?

**360.** Write in Roman notation the sum of 15 and 7.

**361.** Find in the 4th ten the even number that ends in 6 and add 7 to it.

**362.** In the 5th ten find the even number that ends in 8 and add 7.

**363.** How many days in 56 days + 1 week?

**364.** Add 8 to each number ending in 6 and less than 108.

**365.** Write 22 dollars and 16 cents. Under that write 31 dollars and 18 cents. Add them. $3.46 + $8.28 = ?

**366.** Write 48 dollars and 36 cents, and add to it 27 dollars and 38 cents. $5.08 + $1.96 = ?

**367.** To 125 dollars and 58 cents add 134 dollars and 18 cents.

**368.** 16 qt. of milk and 8 qt. of milk = how many gal. of milk?

**369.** 6 ft. + 8 ft. equal how much less than 5 yd.?

**370.** Add:
| $1375.58 | $8934.68 | $2456.76 | $3467.86 |
|----------|----------|----------|----------|
| 8277.16  | 7927.26  | 7778.18  | 8881.38  |

**371.** Add 9 to each number ending in 6 that is less than 109.

**372.** 60 + 90 = ?  60 + 80 = ?  60 + 50 = ?  60 + 70 = ?

**373.** 6 qt. + 9 qt. = how many qt.? How many qt. must be added to equal 4 gal.?

**374.** 16 qt. + 9 qt. = how many gal. and qt.?

**375.** If you measure off 9 in. on a tape measure and then measure off 6 in. more, how many ft. and in. will you have measured off?

Illustrate if necessary.

**376.** Add:
| $366.66 | $276.76 | $346.86 | $868.76 |
|---------|---------|---------|---------|
| 839.19  | 988.19  | 997.09  | 666.09  |

**377.** How many pecks make a bushel?

Use peck and bushel measures to show how many pecks equal a bushel.

**378.** How many pecks of potatoes in 2 bushels of potatoes? 3 bushels? 4 bushels? 5 bushels? 6 bushels?

**379.** When potatoes can be bought for 10 cents a peck, what is the cost of a bushel? 2 bushels?

**380.** If a bushel of potatoes lasts a family a week, how many pecks will they eat in 2 weeks? What other things that we eat are sold by the peck and bushel?

**381.** A pint equals what part of a quart? What part of a bushel equals a peck? A quart equals what part of a gallon? A foot equals what part of a yard?

**382.** To several numbers ending in 5 add 6.

Recall previous combinations and show that many of the following are the same, stated in reverse order.

**383.** $50 + 60 = ?$   $60 + 70 = ?$   $80 + 30 = ?$

**384.** Add:

| $312.75 | $427.35 | $813.25 | $875.45 |
|---------|---------|---------|---------|
| 999.06  | 897.26  | 729.36  | 696.16  |

**385.** 5 qt. + 6 qt. = how many gal. and qt.?

**386.** 15 pk. + 6 pk. = how many pk.? How many more than 5 bu.?

**387.** 25 pk. + 6 pk. = how many pk.? How many pk. less than 8 bu.?

**388.** Write in Roman notation the sum of 5 and 6.   15 and 6.   25 and 6.

**389.** Add 7 to 5, and to 8 other numbers whose unit figure is 5.

**390.** Add:

| $817.35 | $428.75 | $623.85 | $497.35 |
|---------|---------|---------|---------|
| 219.37  | 879.27  | 899.17  | 895.27  |

**391.** 5 pk. + 7 pk. = how many bu.?

**392.** 15 pk. + 7 pk. = how many bu. and pk.?

**393.** 25 pk. + 7 pk. = how many bu.?

**394.** 15 ft. + 7 ft. = how many yd. and ft.?

**395.** $(5 + 7) \div 2 = ?$   $(5 + 7) \div 3 = ?$   $(5 + 7) \div 4 = ?$

**396.** Write in Roman notation the sum of 15 and 7. 25 and 7.

**397.** Add 8 to 5 and to 10 other numbers whose unit figure is 5.

**398.** Add 8 cents to $1.25.   Add 8 cents to $7.75.

**399.** Add:  $122.85    $1285.75    $2775.65    $648.55
         399.58     4938.18     9888.28      49.78

**400.** John caught 28 fish in the morning and 5 in the afternoon.   How many fish did he catch that day?
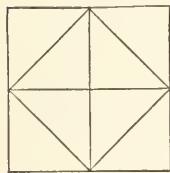


**401.** Copy Fig. 16 by placing triangles that are each one half of an inch square. How long is the perimeter of the figure you have made?

**402.** Copy Fig. 16 by drawing it, measuring your lines carefully.

FIG. 16

Let pupils draw to a scale.

**403.** Show $\frac{1}{2}$ of Fig. 16.   Show $\frac{1}{4}$ of it.   Show $\frac{1}{8}$ of it.

**404.** How many eighths equal $\frac{1}{2}$ of it?   How many eighths equal $\frac{1}{4}$ of it?
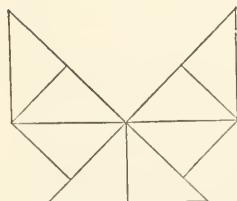


**405.** Copy Fig. 17 by placing triangles. Show $\frac{1}{2}$ of it.   Show $\frac{1}{8}$ of it. How many eighths in $\frac{1}{2}$ of it?   In $\frac{1}{4}$ of it?

FIG. 17

**406.** Copy Fig. 17 by drawing.

**407.** Add 9 to 5 and to 10 other numbers whose unit figure is 5.

**408.** Add : $369.75    $824.65    $614.35    $648.15

        975.19     799.09     999.29     396.79

**409.** 5 pt. + 9 pt. = how many qt.?

**410.** 15 ft. + 9 ft. = how many yd.?

**411.** 15 pk. + 9 pk. = how many bu.?

**412.** Read VI, VIII, XII, XV, XVI, XXVII.

**413.** L stands for 50. How much are L and I?

**414.** Read LXI, LXIII, LXV, LXVII, LXVI.

**415.** Write in Roman notation 22, 33, 17, 37, 13, 61.

**416.** Add 7 to 4 and to all the numbers that are less than 105 and end in 4.

**417.** Add : $394.84    $687.24    $87.34    $672.84

        97.07      97.17     274.37     5998.07

**418.** 14 pk. + 7 pk. = ? How much more than 5 bu.?

**419.** 1 gal. + 7 qt. = how many qt.?

**420.** 34 days + 1 week = how many days?

**421.** Joseph had a kite string 64 feet long. His mother tied on string enough to make it 71 feet long. How much did she lengthen the kite string?

**422.** Copy Fig. 18 by placing inch squares. How long is the perimeter of your figure?



FIG. 18

**423.** Copy Fig. 18 by drawing. Make each square $\frac{1}{2}$ inch each way.

**424.** Make a list of ten numbers whose unit figure is 4, and add 8 to each of them.

**425.** Add : $24.64    $194.34    $294.74    $245.54
           78.28      928.58      998.08       98.28

**426.** 4 pt. of berries and 8 pt. of berries are how many qt.?

**427.** 14 qt. + 8 qt. = how many gal. and qt.?

**428.** 4 pk. of apples and 8 pk. of apples = how many bu.?

**429.** When Henry was going to Boston on the cars he found at 12 o'clock that he had ridden 74 miles. He rode 8 miles more. How far from his home was Boston?

**430.** How long is a square whose perimeter is 12 inches? Draw it. Divide it off into square in. How many are there?

**431.** Add 9 to each of ten numbers whose unit figure is 4.

**432.** To $214.24 add $89.39. To $75.74 add $129.14. To $317.74 add $98.99. To $361.47 add $127.91.

**433.** 4 pecks of apples were in a bin and 9 pecks were put into the bin. How many bushels of apples might be taken from the bin, and how many pecks would be left?

**434.** Add 8 to each of ten numbers that end with 3.

**435.** Add $234.35 to $537.38. Add $596.38 to $398.73.

**436.** 3 qt. + 2 gal. = how many qt.?

**437.** Write in Roman numbers the sum of 13 and 8; of 23 and 8.

**438.** Add 9 to each of ten numbers that end with 3.

**439.** Add $784.39 to $20.94. Add $64.39 to $2125.73.

**440.** 13 pk. + 9 pk. = how much more than 5 bu.?

**441.** Write 12 numbers that end in 2 and add 9 to each of them.

**442.** Add $317.12 to $14.09. Add $923.54 to $96.49.

**443.** Add 9 to the first even number in the fourth ten.

**444.** C stands for 100. What must CC stand for?

**445.** Read CX, CL, CV, CI, CCXV, CCCXX.

**446.** Write in Roman notation 105, 108, 211, 313.

# CHAPTER V

## SUBTRACTION

DIFFERENCE, MINUEND, SUBTRAHEND, POUND, AND OUNCE

### NUMBER TABLE

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 11 | 21 | 31 | 41 | 51 | 61 | 71 | 81 | 91 |
| 2 | 12 | 22 | 32 | 42 | 52 | 62 | 72 | 82 | 92 |
| 3 | 13 | 23 | 33 | 43 | 53 | 63 | 73 | 83 | 93 |
| 4 | 14 | 24 | 34 | 44 | 54 | 64 | 74 | 84 | 94 |
| 5 | 15 | 25 | 35 | 45 | 55 | 65 | 75 | 85 | 95 |
| 6 | 16 | 26 | 36 | 46 | 56 | 66 | 76 | 86 | 96 |
| 7 | 17 | 27 | 37 | 47 | 57 | 67 | 77 | 87 | 97 |
| 8 | 18 | 28 | 38 | 48 | 58 | 68 | 78 | 88 | 98 |
| 9 | 19 | 29 | 39 | 49 | 59 | 69 | 79 | 89 | 99 |
| **10** | **20** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |

**1.** Cover the last three numbers of the first ten in the number table and tell how many of the ten remain in sight.

**2.** Cover the last three numbers of the first twenty and tell how many of the twenty remain. How many tens and how many units remain?

**3.** In the same way take 2 from 30 and show how many units of the broken ten remain, and how many whole tens.

**4.** Show how many units and how many whole tens remain when there is taken in the same way 4 from 40, 5 from 20, 6 from 30, 3 from 70, 2 from 80, 6 from 70, 4 from 30.

**5.** From  30    Lead the children to see that in the written
　　take　4    work they are taking four from one of the tens
　　　　　——    just the same as they did in subtracting on the
number table, and that hence there are only two tens left to be expressed in the remainder.

| **6.** From | 90 | 60 | 80 | 50 | 70 | 40 | 30 | 60 |
|---|---|---|---|---|---|---|---|---|
| take | 7 | 5 | 4 | 6 | 3 | 8 | 9 | 8 |

**7.** Find 40 on the number table and from it subtract 14, taking 4 away first and then 10. Point out the answer.

**8.** In the same way subtract 13 from 30, 12 from 50, 15 from 60, 13 from 70, 14 from 60, 12 from 80.

**9.** From  50    The children should be led to see that writ-
　　take 14    ten subtraction corresponds exactly to the proc-
　　　　　——    ess by which they have subtracted by the help
of squares or the number table, and that it is only a convenient way
of getting the same results.

| **10.** From | 60 | 70 | 80 | 40 | 30 | 90 | 70 | 80 |
|---|---|---|---|---|---|---|---|---|
| take | 23 | 15 | 47 | 26 | 22 | 38 | 35 | 41 |

**11.** When one number is subtracted from another, the result is called their **Difference**. What is the difference between 9 and 11? Between 19 and 21? Between 39 and 41? Between 59 and 61?

**12.** Give the difference between 13 and 17, 13 and 27, 13 and 37, 13 and 47, 13 and 57, 13 and 67, 13 and 77.

It is assumed that chart drill will be given frequently, hence no more chart exercises are given in this chapter.

**13.** 2 from 11 = ?    9 from 11 = ?    2 from 21 = ?
2 from 71 = ?    9 from 71 = ?    9 from 21 = ?

**14.** Name all the numbers that end in 1 and are less than 100, and subtract 2 from each of them. Subtract 9 from each of them.

**15.** Which is more, 21 or 10 + 11 ?   51 or 40 + 11 ?

**16.** From  51    Explain that as we cannot take 2 units from
take  12    1 unit, we take 2 units from 11 units, and write
————    9 units in the answer. 40, or 4 tens, are left,
and from them we subtract the 1 ten, and write the 3 tens in the answer.

**17.** From  81  71  61  41  51  81  91  31  481
take  12  12  22  19  29  29  29  29  139
——  ——  ——  ——  ——  ——  ——  ——  ——

**18.** Kate had 11 cents and spent all but 2 of them. How many did she spend ?

**19.** Find some numbers that are made of a number of tens and one unit, and subtract 3 from each of them. Subtract 8 from each of them.

**20.** Madge had 21 cents and spent 3 cents for a pencil. How many cents had she left ?  She bought a tablet for 7 cents.  How many cents were left ?  She gave all but 8 cents to her little brother.  How many cents did she give him ?

**21.** Find differences :

91    71    141    781    961    31    5141    8191
73    23    18    343    438    18    328    4823
——    ——    ——    ——    ——    ——    ——    ——

**22.** Write in Roman numbers the difference between 3 and 81.

**23.** Subtract 4 from each of several numbers whose unit figure is 1.  Subtract 7 from the same numbers.

**24.** From  281    871    321    961    3481    2191    6111
take  134    537    114    237    1718    1437    3283
——    ——    ——    ——    ——    ——    ——

**25.** Nellie found 11 eggs in a nest, but broke 4 in carrying them to the house. How many eggs did she bring in?

Call for story problems.

**26.** Subtract 5 from each of several numbers that end in 1. Subtract 6 from the same numbers.

**27.**

| From | 2141 | 3171 | 8111 | 3191 | 8171 | 1819 |
|------|------|------|------|------|------|------|
| take | 1614 | 556 | 1655 | 1505 | 1615 | 263 |

**BOARD WORK**

From 11 take_____ $\begin{cases} 2 \\ 5 \\ 9 \\ 3 \\ 7 \\ 4 \\ 8 \\ 6 \end{cases}$

| 6 | 3 | 7 |
|---|---|---|
| 5 | **11** | 9 |
| 2 | 8 | 4 |
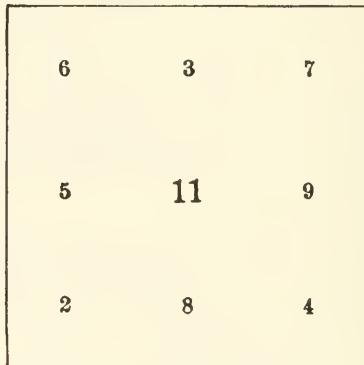
Learn to subtract quickly each of the numbers on the edge of the square from 11. Then change 11 to 21, 31, etc.

**28.** A line lacks 1 inch of being 1 foot long. If 9 inches of it were rubbed out, how long would it be then?

**29.** 21 qt. − 5 qt. = how many gal.?

**30.** 21 pk. − 9 pk. = how many bu.?

**31.** Write in Roman notation the number which is the difference between 21 and 4; the difference between 61 and 4.

**32.** Copy Fig. 1 by placing triangles made by cutting inch-squares in two. Show $\frac{1}{8}$ of the figure. Show $\frac{1}{2}$ of it. How many eighths in $\frac{1}{2}$?
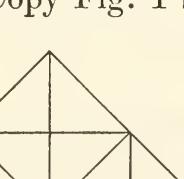


FIG. 1

**33.** Divide the figure into 4 equal parts. How many eighths in $\frac{1}{4}$? In $\frac{2}{4}$? In $\frac{3}{4}$?

**34.** Copy Fig. 1 by drawing.

**35.** Copy Fig. 2 by placing an inch-square and triangles made by bisecting an inch-square. Show $\frac{1}{4}$ of the figure. Show $\frac{1}{2}$ of it. How many fourths equal $\frac{1}{2}$? Show $\frac{3}{4}$ of it.
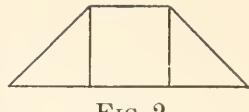


FIG. 2

**36.** Copy Fig. 2 by drawing.

**37.** Copy Fig. 3 by placing triangles. Show $\frac{1}{6}$ of the figure. Show $\frac{1}{3}$ of it. How many sixths in $\frac{1}{3}$? Show $\frac{2}{3}$ of it. How many sixths in $\frac{2}{3}$? Show $\frac{1}{2}$ of it. How many sixths in $\frac{1}{2}$?
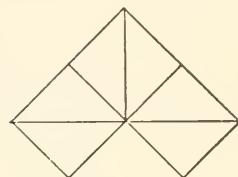


FIG. 3

**38.** Copy Fig. 3 by drawing.

**39.** Show on the number table $\frac{1}{2}$ of 20; $\frac{1}{2}$ of 40; $\frac{1}{2}$ of 60; $\frac{1}{2}$ of 80; $\frac{1}{2}$ of 100.

**40.** Show $\frac{1}{3}$ of 30; $\frac{2}{3}$ of 30; $\frac{1}{3}$ of 60; $\frac{2}{3}$ of 60. $\frac{1}{3}$ of 90 = ? $\frac{2}{3}$ of 90 = ? $\frac{1}{4}$ of 40 = ? $\frac{3}{4}$ of 40 = ?

**41.** From numbers ending in 2 subtract 3. From the same numbers subtract 9.

**42.** Find differences :

| 82 | 92 | 72 | 182 | 562 | 4262 | 8232 | 7212 |
|----|----|----|-----|-----|------|------|------|
| 13 | 43 | 29 | 79  | 33  | 1319 | 2329 | 2449 |

**43.** When butter is 22 cents a pound and lard is 9 cents a pound, the price of a pound of butter is how much more than the price of a pound of lard?

**44.** From numbers ending in 2 subtract 4. From the same numbers subtract 8.

**45.** Find differences :

| 272 | 9262 | 6224 | 8172 | 9182 | 8272 | 9262 |
|-----|------|------|------|------|------|------|
| 134 | 7814 | 2354 | 2518 | 6814 | 2714 | 5438 |

**46.** Eva spent 22 cents in one day.  She spent 8 cents before dinner.  How much did she spend after dinner?

**47.** From numbers ending in 2 subtract 5.  From the same numbers subtract 7.

**48.** Find differences:

| $31.72 | $818.23 | $712.92 | $921.92 | $681.82 | $492.62 |
|--------|---------|---------|---------|---------|---------|
| 6.15   | 391.51  | 87.65   | 238.17  | 126.15  | 385.17  |

**49.** Henry bought a sled for $.72 and traded it for another sled and a nickel.  How much was the other sled worth?

**50.** From numbers ending in 2 subtract 6.

**51.** Find differences:

| 12352 | 81292 | 92342 | 82322 | 98292 | 22222 |
|-------|-------|-------|-------|-------|-------|
| 6146  | 2536  | 24128 | 37156 | 63526 | 17516 |

**52.** The city where Alfred lives is 22 miles from Boston.  When he has ridden 6 miles towards Boston, how far is he from it?

BOARD WORK.

From 12 take .. { 3 7 5 9 6 4 8

(circle with numbers 3, 4, 9, 7, 8, 6, 5, 2 around the edge and 32 at the center)
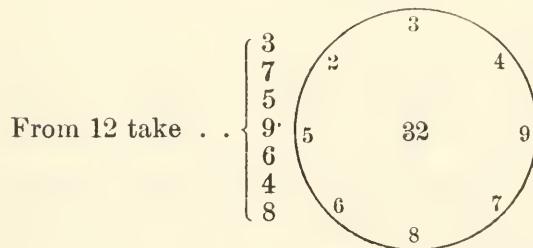
Practice subtracting rapidly each number on the edge of the circle from the number at the center.  Then replace 32 with 52, 72, 92, etc.

**53.** 22 qt. − 4 qt. = how many gal.?

**54.** Write in Roman numbers the difference between 22 and 7.

**55.** Mary bought a dozen eggs and broke 5 eggs carrying them home.  How many were left?

**56.** One dozen minus one half a dozen = how many?

**57.** If 9 eggs were taken from a nest where a dozen eggs were found, how many would remain?

**58.** The number from which another number is subtracted is called the **Minuend.** Make problems, using 12 as a minuend.

**59.** Use 13 as a minuend, subtracting 4. Subtract 4 from eight other numbers that end in 3. From the same numbers subtract 9.

**60.** Read minuends and find differences :

| 8373 | 2383 | 9323 | 4393 | 6373 | 33333 | 7533 |
|------|------|------|------|------|-------|------|
| 3439 |  924 | 5439 | 2489 | 2429 | 21919 | 3214 |

**61.** 13 qt. of berries $-$ 9 qt. of berries $=$ how many gal.?

**62.** From several numbers ending in 3 subtract 5. From the same numbers subtract 8.

**63.** Find differences :

| 7343 | 4283 | 6293 | 8083 | 9639 | 33333 | 8343 |
|------|------|------|------|------|-------|------|
|  985 |  948 | 1745 | 4728 | 6255 | 18175 | 2519 |

**64.** $(13-5) \div 2 = ?$    $(23-5) \div 2 = ?$    $(12-6) \div 3 = ?$

$(22-7) \div 3 = ?$    $(13-5) \div 4 = ?$    $(33-6) + 4 = ?$

**65.** If a piece of ribbon 5 ft. long is cut from a piece 4 yards and 1 foot long, how much ribbon is left?

**66.** Write in Roman notation the difference between 73 and 5; between 33 and 5.

**67.** From numbers ending in 3 subtract 6. From the same numbers subtract 7.

**68.** $823 - 456 = ?$       $733 - 276 = ?$       $1039 - 462 = ?$

**69.** 23 pk. $-$ 7 pk. $=$ how many bu.?

See board work used with numbers 11 and 12.

**70.** Write in Roman numbers the difference between 7 and 33.

**71.** 23 qt. − 7 qt. = how many gal.?

**72.** 33 pk. − 9 pk. = how many bu.?

**73.** 23 ft. − 5 ft. = how many yd.?

**74.** John had 13 cents and spent 8 of them. How many were left?

**75.** 13 Readers belong to the library and 6 are in use. How many are on the shelves?

**76.** Make problems in which you use 13 as a minuend.

**77.** Read XV, XIII, C, CVI, CX, CXIII, CXXII.

**78.** IV means 4. Read XIV, XXIV, XXXIV, LXIV.

Show that when the smaller Roman numeral is written before the larger, their difference is expressed.

**79.** What does IX mean? How can you tell? Read XIX, XXIX, LIX, LXXIX, XXXIX.

**80.** Write in Roman numbers, 59, 89, 39, 14, 64, 74, 24.

**81.** From 14, and from some other numbers whose unit figure is 4, subtract 5. Subtract 9 from the same numbers.

**82.** Find differences:

| 9484 | 8474 | 7494 | 2094 | 6434 | 7494 | 8484 |
|------|------|------|------|------|------|------|
| 6935 | 3529 | 935 | 1829 | 1875 | 2965 | 2569 |

**83.** Of 14 horses hauling loads, 5 were white. How many of them were not white horses?

**84.** Write in Roman notation the number that is the difference between 14 and 5; between 24 and 9.

**85.** 2 weeks − 5 days = how many days?

**86.** From several numbers whose unit figure is 4 subtract 6. From the same numbers subtract 8.

**87.** Find differences:

| 2494 | 3484 | 7474 | 9484 | 11464 | 14846 | 9234 |
|------|------|------|------|-------|-------|------|
| 1866 | 1628 | 2628 | 7866 | 628 | 8265 | 4968 |

**88.** 8 yd. − 6 ft. = how many ft.? How many yd.?

**89.** 6 gal. − 6 qt. = how many qt.?

**90.** Write the difference between XXXIV and VIII.

**91.** From several numbers whose unit figure is 4 take 7.

**92.** Find differences :

| 324 | 674 | 924 | 1246 | 6549 | 846 | 7434 | 6434 | 3444 |
|-----|-----|-----|------|------|-----|------|------|------|
| 207 | 538 | 619 | 162  | 2275 | 193 | 2918 | 2726 | 1968 |

**93.** Edwin had 24 marbles and lost all but 7. How many did he lose?

Use board work as with numbers 11 and 12.

**94.** Write in Roman numbers the number that is the difference between 14 and 8 ; between 24 and 8 ; between 34 and 6.

**95.** A hen sat upon 1 dozen and 2 eggs. 5 eggs failed to hatch. How many chickens came out?

**96.** If a room is 24 ft. long and 9 ft. wide, how many ft. greater is its length than its width? How many yd.?

**97.** If you measure off a line 14 feet long on the floor, and another line 8 feet long, what is the difference between them in feet? In yards?

**98.** Make problems using 14 as a minuend.

**99.** Read X, I, V, L, C, IV, IX, XIX, XXIX.

**100.** X written before L means 40. Can you tell why? Read XL, XLI, XLII, XLIII, XLIX, CL, CXL.

**101.** Write in Roman notation the difference between 40 and 9 ; 4 and 40.

**102.** From 15, and other numbers whose unit figure is 5, subtract 6. From the same numbers subtract 9.

**103.** Find differences :

| 975 | 7595 | 6935 | 8357 | 7358 | 4595 |
|-----|------|------|------|------|------|
| 256 | 4976 | 2486 | 2994 | 2466 | 1936 |

**104.** Joseph had 65 feet of kite string, and his mother used 6 feet of it to tie up a bundle. How many feet of string had he left?

**105.** Express in Roman numbers the difference between 15 and 6.

**106.** From 15, and other numbers ending in 5, take 7. From the same numbers take 8.

**107.** Find differences :

| 175 | 735 | 8595 | 1125 | 3525 | 6352 | 8958 | 7257 | 9859 |
|-----|-----|------|------|------|------|------|------|------|
| 128 | 219 | 867  | 1016 | 2778 | 2161 | 6274 | 2164 | 3694 |

**108.** 15 qt. − 7 qt. = how many gal.?

**109.** 25 pk. − 2 bu. = how many pk.?

**110.** In Roman numbers write the difference between 7 and 35; between 45 and 8.

**111.** If I saw off 8 in. from a board that is 1 ft. and 3 in. long, how many in. are left?

**112.** 355 is a minuend and 127 the number to be subtracted. What is the difference?

**113.** A number which is subtracted from another number is called a **Subtrahend.** Make a problem with 9 as a subtrahend.

**114.** Make problems in which you use 15 as a minuend, and some number less than 10 for a subtrahend.

**115.** Subtract 7 from 16, and from other numbers ending in 6. From the same numbers subtract 9.

**116.** Find differences :

|               | $3.76 | $5.76 | $28.26 | $9.46 | $18.68 | $9.36 |
|---------------|-------|-------|--------|-------|--------|-------|
| Subtrahend    | 2.37  | 2.49  | 9.87   | 2.59  | 13.75  | 4.98  |

**117.** Write in Roman notation the difference between 56 and 9. Between 66 and 7.

**118.** Anna is 16 years old and Mary is 9 years old. How much older is Anna than Mary?

**119.** William is 16 years old and Thomas is 9 years younger. How old is Thomas?

**120.** I have a string that is 1 ft. and 4 in. long. If I break off a piece 7 in. long, how much will remain?

**121.** Anna expected to spend 26 days in visiting a friend, but was called home a week sooner than she expected. How long did she stay?

**122.** How many ounces make a pound?

Let the children weigh out sand, sawdust, coal, or some other substance until they realize the meaning of the terms "pound" and "ounce."

**123.** How many ounces in 1 pound lacking 7 ounces? 1 pound lacking 9 ounces?

**124.** At 10 cents a pound, how many pounds of candy can be bought for 50 cents?

**125.** $\frac{1}{2}$ a pound of sand weighs how many ounces? $\frac{1}{2}$ a pound of sugar weighs how many ounces?

**126.** Use 8 as a subtrahend with each number less than 100 whose unit figure is 6.

**127.** Find differences:

| $16.16 | $26.36 | $278.36 | $376.46 | $236.56 | $376.86 |
|--------|--------|---------|---------|---------|---------|
| 8.08   | 8.18   | 54.28   | 18.28   | 98.38   | 98.78   |

**128.** Make problems using 16 as a minuend, and a smaller number as a subtrahend.

**129.** Use 9 as a subtrahend with each of the numbers less than 120 whose unit figure is 7.

**130.** What number added to 39 makes 47? What number added to 339 makes 347?

**131.** Find differences:

| $377.57 | $627.87 | $547.27 | $2275.87 | $648.77 |
|---------|---------|---------|----------|---------|
| 88.29   | 38.39   | 68.49   | 999.38   | 294.89  |

**132.** Anna had a dime and 7 cents and bought an 8-cent doll. How much had she left?

**133.** A flower bed is 27 feet long, and John has weeded 9 feet of it. How much remains to be weeded?

**134.** Make problems using 17 as a minuend.

**135.** XC means 90. Can you tell why?

**136.** Read XCI, XCV, XCIV, XCIX, XCVI, XCIII, XCVIII.

**137.** In Roman numbers write:

All the numbers that end in 9 up to 99. All the numbers that end in 4 and are less than 100. Your age. All the even numbers in the first two tens.

**138.** Subtract 9 from several numbers ending in 8.

**139.**

| Minuends    | 727 | $13.47 | $67.27 | $67.75 | $98.75 |
|-------------|-----|--------|--------|--------|--------|
| Subtrahends | 259 | 9.18   | 29.18  | 38.69  | 26.97  |
| Differences? |    |        |        |        |        |

# CHAPTER VI

## APPLICATIONS OF ADDITION AND SUBTRACTION

INDUSTRIAL PROBLEMS, DAYS IN MONTHS, ODD NUMBERS

**1.** Add 729 to itself.  Add 1348 to itself.

**2.** Find the sum of 648 and the number that is 1 greater than 648.

**3.** Find the sum of 276 and the number that is 1 less than 276.

**4.** Add 7 times 2 to 45.  $(2 \times 8) + (10 \times 7) = ?$

**5.** Add 6 times 2 to the 6th multiple of 10.

**6.** What must be added to 9 to equal 12?  17?  15?

**7.** $26 - ? = 13.$  $64 - ? = 58.$  $35 - ? = 27.$  $26 - ? = 17.$

**8.** Copy Fig. 1 by drawing 3 inch-squares and bisecting them.

**9.** Show $\frac{1}{6}$ of the figure.  Show $\frac{5}{6}$ of it. Show $\frac{1}{3}$ of it.  How many 6ths does $\frac{1}{3}$ equal? Show $\frac{2}{3}$ of it.  How many 6ths in $\frac{2}{3}$?

FIG. 1

**10.** $\frac{6}{6} - \frac{1}{6} = \frac{?}{6}.$     $\frac{5}{6} - \frac{1}{2} = \frac{?}{6}.$     $\frac{5}{6} - \frac{1}{3} = \frac{?}{6}.$     $\frac{2}{3} - \frac{1}{6} = \frac{?}{6}.$

**11.** Show on the number table $\frac{1}{5}$ of 50.  $\frac{2}{5}$ of 50.  $\frac{4}{5}$ of 50.

**12.** Show $\frac{1}{6}$ of 60.  $\frac{5}{6}$ of 60.  $\frac{1}{4}$ of 40.  $\frac{3}{4}$ of 40.

**13.** Add $\frac{1}{5}$ of 50 to 50.  To 25.  To 30.  To 20.

**14.** Add $\frac{1}{6}$ of 60 to 60.  To 30.  To 40.  To 25.

**15.** Subtract $\frac{1}{3}$ of 30 from 30.  $\frac{1}{3}$ of 30 from 75.
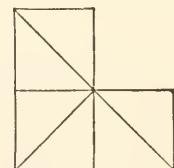
**16.**  Subtract $\frac{1}{4}$ of 40 from 40.   $\frac{1}{4}$ of 40 from 60.

**17.**  Find the difference between 464 and 820.   Which number is the minuend?

**18.**  Find the difference between 398 and 785.   Which is the greater number, the minuend or subtrahend?

**19.**  Find the difference between 4246 and 3278.   Where is the minuend written in subtraction?

**20.**  484 is how many more than 376?   Which number is the subtrahend?

**21.**  324 is how many less than 486?

**22.**  How many children are there in a ward school which has 139 children in the first grade, 137 in the 2d, 747 in the 3d, 128 in the 4th, 98 in the 5th, 83 in the 6th, 77 in the 7th, and 48 in the 8th?

**23.**  158 children were in the first grade of a school, and 43 were transferred to another building.   How many remained?

**24.**  There were 676 children in a school building when 183 others were transferred to it.   How many were there then?

**25.**  There were 392 books in the school library, and 219 new ones were added.   How many were in the library then?

**26.**  18,943 bushels of coal were dug from a mine in one week and 29,312 the next week.   How many in the two weeks?

Take up the subject of coal mining, showing coal and pictures of mines, and reading or telling stories about mines and miners.   Then let the children give problems about them.

In the same way deal with the different industries referred to in the following problems, letting the children furnish facts when they can about industries of which they have some knowledge.

**27.** 18,946 bushels of coal were dug from a mine in one week, 29,321 the next week, and 31,457 the next week. How many were dug out in the three weeks?

**28.** 7281 cattle were on a cattle ranch and 943 were killed. How many were left?

**29.** An iron foundry made 875 stoves in one week, 873 in another week, and 884 in another week. How many in all?

**30.** A cotton mill wove 10,876 yd. of cloth in one week, 9343 in the next week, and 11,833 in the next week. How many in the three weeks?

**31.** A farmer raised 2343 bu. of corn in one year, 3124 in another year, 1957 in another year, and 2417 in another year. How many did he raise in those four years?

**32.** One farmer raised 1247 bu. of wheat, another farmer raised 3268 bu., and another farmer raised 5324 bu. How many bushels of wheat did they all raise?

**33.** A lawyer earned $5727 in one year, $2938 in the next year, and $11,536 in the third year. How many dollars did he earn in the three years?

**34.** Gold worth 12,342 dollars was taken from a gold mine in one month, 98,676 dollars' worth in the next month, and 321 dollars' worth in the next month. How many dollars were taken out in the three months?

**35.** A farmer sent to market one year 1224 pounds of butter, 1376 pounds the next year. 1312 pounds the next year, and 1678 pounds the next year. How many pounds of butter did he send in the four years?

**36.** A milkman sold 943 quarts of milk in Jan., 836 in Feb., 972 in Mar., and 937 in Apr. How many quarts did he sell in all?

**37.** Copy and learn :

Thirty days hath **September, April, June,** and **November.**
All the rest have thirty-one, except February alone,
Which has just twenty-eight in fine, till leap year gives it twenty-nine.

Let children consult calendar.

**38.** Copy, writing the number of days in each month opposite its name :

SPRING $\begin{cases} \text{March} \\ \text{April} \\ \text{May} \end{cases}$ SUMMER $\begin{cases} \text{June} \\ \text{July} \\ \text{August} \end{cases}$

FALL $\begin{cases} \text{September} \\ \text{October} \\ \text{November} \end{cases}$ WINTER $\begin{cases} \text{December} \\ \text{January} \\ \text{February} \end{cases}$

**39.** How many days in the spring months? In the summer months? In the fall months? In the winter months?

**40.** How many days in the last 5 months of the year? In this month and last month?

**41.** The year in which February has 29 days is called leap year, and comes once in 4 years. A boy named Walter Jones was born February 29th, 1884. In what year can he first celebrate his birthday on the 29th of February?

**42.** Find the number of days in the month in which you were born, add to it the number in the month before and the month after.

**43.** Find the number of days in the month in which Christmas comes, add to it the days in the month before and the month after.

**44.** How many days in the first ten months of a leap year?

**45.** Add the days in the month in which Thanksgiving comes to those in the month after and the month before.

**46.** A store sold 927 yards of carpet in one day, 713 the next, and 837 the next. How many in all?

**47.** Susan's father earned $1500 in one year and spent $1321. How much did he save?

**48.** John gets 2 cents a quart for picking berries for a farmer and 1 cent a quart for selling them. How many cents did he earn in the day in which he picked 12 quarts and sold 10 of them?

**49.** A bookkeeper earned $1400 in one year and saved $227. How much did he spend?

**50.** A farmer raised 2827 bushels of corn; another farmer raised 3431, another 9852, and another 6856. How many bushels did all raise?

**51.** Mr. Smith's salary was $1300 last year and $1450 this year. How much more does he receive this year than last year?

**52.** Mr. Ward has 3 horses, Black Beauty, Whiteface, and Fleet. Black Beauty is valued at $375, Whiteface at $125, and Fleet at $575. How much are they all worth?

**53.** Anna worked 73 problems in addition in 1 week, her sister worked 98, and her brother 113. How many did they all work?

**54.** John had a knife worth 49 cents, which he traded for William's knife and 2 nickels. How much was William's knife worth?

**55.** Find the sum of all the even numbers in the first ten.

**56.** Numbers which are not even are called **Odd Numbers**. Write all the odd numbers in the first ten. Find their sum.

**57.** Write all the odd numbers in the second ten. Find their sum.

**58.** Find the sum of the odd number which comes just before 30 and the odd number which comes just after 30.

**59.** Draw a horizontal line 9 inches long, and divide into halves.

**60.** Draw a vertical line 5 inches long, and find how many inches in $\frac{1}{2}$ of it.
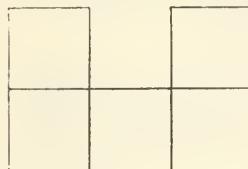


Fig. 2

**61.** Copy Fig. 2 by drawing inch-squares. Divide the figure into two equal parts by one straight line. How many inch-squares in each half?

**62.** Can you divide a group of 9 children into 2 equal groups?

**63.** Can you divide 7 apples equally between two boys without cutting any apples into halves?

**64.** Can you find a whole number that is just $\frac{1}{2}$ of 11?

**65.** Think of different odd numbers, and see if you can find a whole number that is just $\frac{1}{2}$ of any of them.

**66.** Think of some even numbers, and tell what $\frac{1}{2}$ of each of them is.

**67.** How are even numbers different from odd numbers?

**68.** Make a list of the odd numbers in the first two tens, and find their sum.

**69.** Make a list of the even numbers in the first two tens, and find their sum.*

**70.** Mary was in school 20 days in the month of January. How many days was she out of school?

**71.** Use 23487 as a minuend and 14798 as a subtrahend.

**72.** When one number is subtracted from another, sometimes the difference is called the **Remainder**. Find the remainder when 2987 is subtracted from 3012.

**73.** Arthur had $38.72 and spent $29.86. How much was the remainder?

**74.** Alfred took $12.38 from $21.75. How much was the remainder?

**75.** Find the last remainder when from $829.75 there is subtracted first $28.93, then $478.38 from what was left, then $312.69 from what was left.

**76.** Subtract 9 from 50 and write the remainder in Roman numbers.

**77.** Read C, CX, CL, CI, CIII, CIX, CXL, CXLIII, CXX, CCXXV, CCCXV, CCCCLX, CXLIX.

**78.** Write in Roman notation all the numbers of two places that have 9 in the tens' place; all the numbers of two places that have 9 in the units' place.

* The game of Odd or Even is useful at this stage. Having the class at the board, the teacher, or the child leader, holds out her closed hand, containing a number of objects, — grains of corn or pieces of paper. Each child writes "odd" or "even." When the hand is opened, those who guess correctly credit themselves with the number, the others with 0. After five trials the scores are added. If instead of using objects, the leader simply writes a number on paper, large numbers can be conveniently used, and the game thus varied.

**79.** What page of your book are you reading? The numbers which show the pages are written in **Arabic notation.** In which kind of notation are the numbers in the number table written?

**80.** Write in Arabic notation CXCV, CCXCI, CCCXCVI, CCCCXCIV.

**81.** Write in Arabic notation, and add, CLXXV, LIV, LXXXIV, LXIX, XLIX, CXLVIII.

**82.** Subtract 4 from 91 and write the remainder in Roman numbers.

**83.** Write in Arabic notation CCXCV and CCCLXXVI and find their difference.



FIG. 3

**84.** Copy Fig. 3 by placing triangles made by bisecting inch-squares. Show $\frac{1}{6}$ of your figure. $\frac{6}{6} - \frac{1}{6} = ?$

**85.** Divide the figure into halves. How many sixths in one half?

**86.** Copy Fig. 3 by drawing.

**87.** Copy Fig. 4 by placing triangles. How many triangles does it take? How many triangles would it take to make five such figures? To make 7 such figures? To make 10 such figures?

**88.** Show $\frac{1}{10}$ of your figure. $\frac{10}{10} - \frac{1}{10} = ?$ $\frac{9}{10} - \frac{3}{10} = ?$ $\frac{6}{10} - \frac{4}{10} = ?$



FIG. 4

**89.** Divide the figure into halves. How many 10ths in $\frac{1}{2}$?

**90.** Can you take 4 triangles away from Fig. 4 and leave it just like Fig. 3? Copy Fig. 4 by drawing.
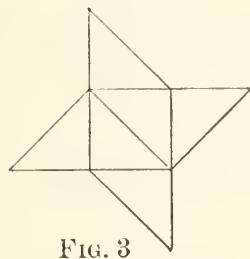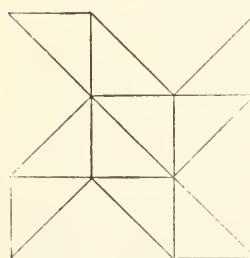
**91.** Copy Fig. 5 by placing triangles.  How many triangles does it take?  How many triangles would it take to make 9 such figures?  To make 6 such figures?

**92.** Divide the figure into halves and show how many tenths in $\frac{1}{2}$.

**93.** Can you take away 4 triangles from the figure so as to make a figure just like Fig. 3?



Fig. 5

**94.** Can you show how Fig. 5 can be made just like Fig. 4 by turning four of the triangles around?  Copy Fig. 5 by drawing.

**95.** Subtract 327 from 982.  Subtract it again from the remainder and again from the second remainder and see if your answer is 1.

**96.** Keep on subtracting 224's from 1123 in the same way until the remainder is 3.

**97.** Subtract 123's from 369 until nothing remains. How many 123's does it take to equal 369?

**98.** Add 32's together until you get 192.  How many 32's did you use?

**99.** Add 24's together until you get 144.  How many 24's in 144?

**100.** Write the names of the months that have 31 days, and find how many days in all of them.

**101.** Five vertical lines are drawn on the board one foot apart.  How far apart are the two outside lines?

Let the children try imagining before illustrating.

**102.** If it costs 10 cents to saw a log into two pieces, how much will it cost to saw it into three pieces?
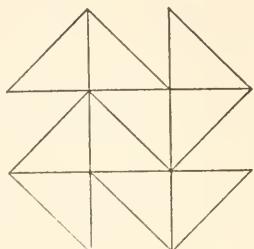
# CHAPTER VII

## FIVES

### Equilateral Triangles, Roman Numerals D and M, Quotient

#### NUMBER TABLE*

| 1 | 11 | 21 | 31 | 41 | 51 | 61 | 71 | 81 | 91 |
|---|----|----|----|----|----|----|----|----|-----|
| 2 | 12 | 22 | 32 | 42 | 52 | 62 | 72 | 82 | 92 |
| 3 | 13 | 23 | 33 | 43 | 53 | 63 | 73 | 83 | 93 |
| 4 | 14 | 24 | 34 | 44 | 54 | 64 | 74 | 84 | 94 |
| **5** | **15** | **25** | **35** | **45** | **55** | **65** | **75** | **85** | **95** |
| 6 | 16 | 26 | 36 | 46 | 56 | 66 | 76 | 86 | 96 |
| 7 | 17 | 27 | 37 | 47 | 57 | 67 | 77 | 87 | 97 |
| 8 | 18 | 28 | 38 | 48 | 58 | 68 | 78 | 88 | 98 |
| 9 | 19 | 29 | 39 | 49 | 59 | 69 | 79 | 89 | 99 |
| **10** | **20** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |

**1.** Begin with 5 and count by fives to 100

Let pupils practice this until they can count rapidly.

**2.** The number table is divided into groups of five numbers. Name all the numbers in the first group of

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* Charts containing this and other number tables should remain upon the wall in sight of the children all the time, except when tests are given. By this means the children unconsciously become familiar with the multiples and their relative positions.

five.  Name all the numbers of the second five.  The third five.  The fourth five.  The fifth five.

**3.**  Show the sixth five.  Show the next five.  Which five is it?

**4.**  Point out the second five and name the first and last number of it.

**5.**  Show the third five and name the first and last number.

**6.**  What number in the third five is next to the last?

**7.**  What is the last number of the fourth five?  Of the fifth five?  Of the sixth five?  Of the seventh five?

**8.**  In which five is 13?  29?  31?  46?

**9.**  Name an odd number in the seventh five.

Let the children select numbers and tell in which five they are found.

**10.**  Name in order the multiples of five up to 100. Learn to name them without looking at the number table. Fill out and learn the following table of fives :

| | | |
|---|---|---|
| 1 five  = | 5 fives = | 9 fives = |
| 2 fives = | 6 fives = | 10 fives = |
| 3 fives = | 7 fives = | 11 fives = |
| 4 fives = | 8 fives = | 12 fives = |

Pupils must first learn the multiplication tables in regular order so that they may see the aggregations of which multiples are composed.  But in later work care should be taken not to use a fixed order.  The child should learn the statements of the multiplication tables as separate facts, so that each may spring singly into his consciousness when needed.

**11.**  Name the second multiple of 5; the fourth multiple of 5; the fifth, the sixth, the tenth, the eighth, the seventh.

**12.**  3 fives = how many?  What is $\frac{1}{3}$ of 15?  5 is $\frac{1}{3}$ of what number?

**13.** 5 is $\frac{1}{4}$ of what number? How can you tell? 5 is $\frac{1}{5}$ of what? $\frac{1}{6}$ of what? $\frac{1}{8}$ of what? $\frac{1}{12}$ of what? $\frac{1}{7}$ of what? $\frac{1}{10}$ of what? $\frac{1}{9}$ of what? $\frac{1}{11}$ of what?

**14.** 50 is which multiple of 5? Name another number that 50 is a multiple of.

**15.** 10 is which multiple of 5? Name another number that 10 is a multiple of.

**16.** Which multiple of 5 is 15? 25? 35? 40? 60?

**17.** Name multiples of 5 and tell quickly which multiples they are.

**18.** Name all the numbers in the 6th group of five and tell which is the middle number.

**19.** 5 cents + 5 cents + 5 cents + 5 cents = how many dimes?

**20.** 5 is what part of 25? Of 40? 20? 60? 35?

**21.** Mary had 15 cents, and Anna had $\frac{1}{3}$ as many. How many had Anna?

**22.** How much is $\frac{2}{3}$ of 15 cents? $\frac{2}{3}$ of 30 cents?

**23.** How many times can a line 5 inches long be measured off on a line 20 inches long? On a line 15 in. long? On a line 35 in. long? On a line 45 in. long?

**24.** 5 multiplied by 3 = ? $5 \times 6$ = ? $5 \times 8$ = ?

**25.** What number is 3 more than 4 fives? 2 more than 5 fives?

**26.** How much is 1 less than 3 fives? 2 less than 5 fives?

**27.** Which is more, 17 or 3 fives? How much more?

**28.** Which is more and how much more, 4 fives or 18? 2 fives or 14? 4 fives or 23?

**29.** Which is more and how much more, 6 fives or 28? 4 fives or 2 tens? 10 fives or 5 tens? 5 fives or 26?

**30.** How many nickels equal 15 cents ?   20 cents ?

**31.** If 6 little girls have a nickel apiece, how many cents' worth of peaches can they all buy ?

**32.** How many cents will it cost for 7 children to ride on a street car, if they each pay 5 cents fare ?

**33.** Point out the last number of the fifth five, add 2 fives, and point out the result.

**34.** Add 2 fives to 30 and point out the result.   How many fives does it equal ?

**35.** Add 2 fives to 40.   To 50.   35.   45.   55.   15.

**36.** Add 3 fives to 10.   20.   15.   35.   45.   30.   40.

**37.** Mary may think of an even number and tell which five it is in.   The class may guess the number.

**38.** John may think of an odd number and tell which five it is in.

**39.** Begin at 100 and count backwards by fives quickly.

**40.** Take 2 fives from 20.   45.   35.   40.   50.   30.

**41.** How many fives in 15?   30?   40?   55?   35?

**42.** How many fives in a ten and half a ten ?   In 2 tens and a half ?   In 3 tens and $\frac{1}{2}$ a ten?

**43.** Place two rows of five squares each as in this figure, and tell how many squares there are.   Place another row of five squares above them and tell how many squares there are.   Keep on placing rows of 5 squares each until the figure is as wide as it is long or until it is square.   How many little squares are there in it then? Find the middle square of all and write M in it.

**44.** $25 \div 5 = ?$   $40 \div 5 = ?$   $15 \div 5 = ?$   $35 \div 5 = ?$
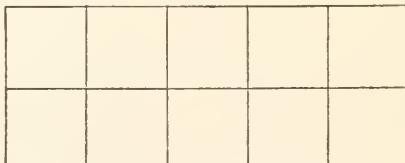
**45.** Read XC, XCIV, CCLII, CCCX, CCCLXVI.

**46.** D. stands for 500 in Roman notation. Read DC, DL, DXC, DCCC, DXLVIII, DCLXVI, DCCIX.

**47.** Write in Arabic notation DCCXXV and DCCCXXXVII. Then find their sum.

**48.** Write in Roman notation 605, 607, 609, 611.

BLACKBOARD EXERCISE
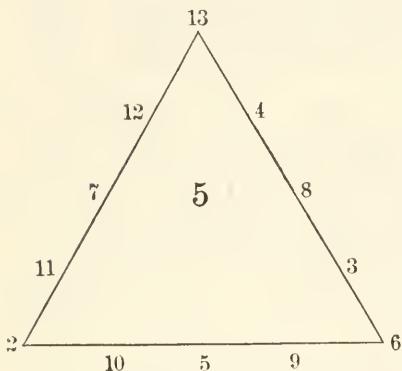


Multiply 5 by each of the numbers on the edge of the triangle. Answer quickly.



**49.** Triangles whose sides are all equal like Fig. 1 are called **Equilateral Triangles**. Are those triangles equilateral that are made by cutting a square inch into halves?

Fig. 1

**50.** If each side of Fig. 1 were 5 in. long, how long would the perimeter be?

Equilateral triangles should be furnished for the following work.



**51.** Copy Fig. 2 by placing equilateral triangles. If each side of the triangles you used were 5 in. long, how long would the perimeter of your figure be?

Fig. 2
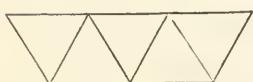
**52.** Copy Fig. 3 by placing equilateral triangles. If each side of the triangles were 5 in. long, what would be the length of a line that would lie all around the figure?



Fig. 3

**53.** Show $\frac{2}{5}$ of Fig. 3. Show $\frac{4}{5}$ of it. $\frac{4}{5} - \frac{2}{5} = ?$

**54.** Draw a vertical line 5 in. long. Divide into inches and mark the divisions. One in. is what part of 5 in.? 3 in. are what part of 5 in.? 4 in. are what part of 5 in.?

**55.** How much do $\frac{4}{5}$ of the line lack of being the whole line? Show $\frac{5}{5}$ of the 5-inch line.

**56.** Draw a line $\frac{6}{5}$ as long as the 5-inch line. How much longer is it than the 5-inch line?

**57.** Draw a line $\frac{7}{5}$ as long as the 5-inch line. $\frac{9}{5}$. $\frac{10}{5}$.

**58.** Mary has 5 cents, and Anna has $\frac{1}{5}$ as much. How many cents has Anna? John has $\frac{4}{5}$ as much money as Mary. How many cents has John? Kate has $\frac{6}{5}$ as much as Mary. How many cents has Kate? Thomas has $\frac{8}{5}$ as much as Mary. How many cents has Thomas?

Illustrate with actual money if the children fail to think out this work.

**59.** $\frac{6}{5}$ of anything is how much more than the whole of it? $\frac{7}{5}$ is how much more than the whole? $\frac{9}{5}$? $\frac{10}{5}$?

**60.** Numbers like $\frac{1}{5}, \frac{2}{3}, \frac{5}{4}$, that show parts of anything are called **Fractions**. Write some other fractions.

**61.** Draw a line 3 in. long and another line $\frac{1}{3}$ longer. How many inches in the long line?

**62.** Show on the number table $\frac{1}{5}$ of 25. Show $\frac{2}{5}$ of 25; $\frac{3}{5}$ of 25; $\frac{4}{5}$ of 25.

**63.** If John had 25 cents and James had $\frac{2}{5}$ as much, how many cents would James have?

**64.** Make story problems about fifths of 25.

**65.** How many fives must be added to 20 to equal 35? 45? 30?

**66.** How many fives must be subtracted from 60 to leave 45? To leave 35? 50? 40? 20? 30? 55?

**67.** 3 fives are how many more than 13 ?   6 fives − 3 = ?

**68.** What must be added to 8 fives to equal 43 ?   To 7 fives to equal 39 ?

**69.** What must be subtracted from 16 to leave 3 fives ? 2 fives ?   1 five ?

**70.** 33 is how much more than 6 fives ?   Than 5 fives ?

**71.** 3 fives + 4 = ?   4 fives + 2 = ?   8 fives + 3 = ?

**72.** How much does 49 lack of being equal to 10 fives ? 47 is how many more than 9 fives ?

**73.** Can you bring in (or name) a flower that has five petals ?   How many petals would 7 such flowers have ? 9 such flowers ?

**74.** How many school days in 3 weeks ?   5 weeks ?   7 weeks ?   11 weeks ?

**75.** How many cents = 10 nickels and 3 cents ?   8 nickels and 4 cents ?   4 nickels and 5 cents ?

**76.** 6 times 5 pk. = how many bu. and pk. ?

**77.** How many tens = 4 fives ?   6 fives ?   10 fives ?

### BLACKBOARD EXERCISE
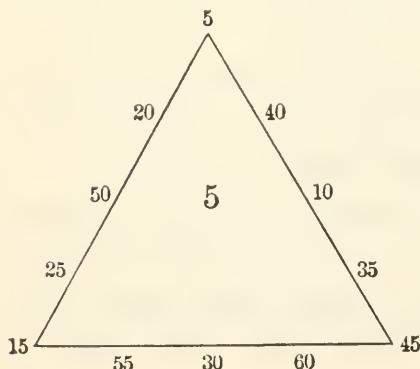


Divide quickly each number on the edge of the triangle by 5.

**78.** The number that shows how many times one number is contained in another is called a **Quotient.** What is the quotient of 25 divided by 5? 16 divided by 2?

**79.** Give quotients of $50 \div 10$; $30 \div 5$; $24 \div 2$; $55 \div 5$.

**80.** $\frac{15}{5} = ?$ (This is read "15 divided by 5" or "15 fifths.")

**81.** $\frac{50}{10} = ?$ $\frac{80}{10} = ?$ $\frac{22}{2} = ?$ $\frac{40}{5} = ?$ $\frac{60}{5} = ?$ $\frac{70}{10} = ?$

**82.** $\dfrac{10 \times 4}{2 \times 2} = ?$  Show the process of cancellation and let the pupils prove by trial with small numbers that the same result is obtained as by dividing the product of the numbers above the line by the product of those below. Do not attempt to give the underlying principles, as the power to perceive them usually comes at a much later stage of the child's psychological development.

**83.** $\dfrac{10 \times 20 \times 11}{2 \times 5 \times 55} = ?$   **85.** $\dfrac{33 \times 5 \times 8}{11 \times 2 \times 15} = ?$   **87.** $\dfrac{6 \times 5 \times 11}{2 \times 44 \times 25} = ?$

**84.** $\dfrac{55 \times 8 \times 10}{2 \times 11 \times 20} = ?$   **86.** $\dfrac{12 \times 5}{2 \times 3 \times 2} = ?$   **88.** $\dfrac{30 \times 2}{2 \times 10 \times 11} = ?$

The division of one indicated product by another by cancellation may be made an interesting class exercise, and it is very useful in helping children to become expert in recognizing ratios. As new numbers and their multiples are learned give class exercises in this work, combining the new numbers with those previously learned.

**89.** Show on the number table
$\frac{1}{7}$ of 35 ; $\frac{2}{7}$ of 35 ; $\frac{3}{7}$ of 35 ; $\frac{5}{7}$ of 35 ; $\frac{4}{7}$ of 35.

**90.** If Thomas had 35 cents and William had $\frac{2}{7}$ as many, how many did William have?

**91.** Make story problems about sevenths of 35.

**92.** Find the 6th multiple of 5 and add 7 to it.

**93.** Add 8 to the 4th multiple of 5. To the 7th. To the 9th? To the 11th?

**94.** Take 6 from the 12th multiple of 5. From the 9th. From the 7th? From the 4th? From the 11th?

**95.** Add 2 tens to the 6th multiple of 5. To the 9th.

**96.** Add 3 twos to the 3d multiple of 5. To the 7th.

Let pupils compose similar questions and bring them to the recitation to be solved by their classmates.

**97.** A child was asked, " What is a multiple of 5 ? " She answered, " The number you get when you multiply 5 by any number is a multiple of 5." Was she right ? Explain.

**98.** What is a multiple of 10 ? A multiple of 2 ?

**99.** What number is the fourth multiple of 10 ? What number must 10 be multiplied by to give the fourth multiple of 10 ?

**100.** By what must 5 be multiplied to give the third multiple of 5 ?

**101.** By what must 5 be multiplied to give 45 ? Which multiple of 5 is 45 ?

**102.** If you were to spend 5 minutes a day playing with a kitten, how much time would you spend in a week ?

**103.** A pansy has 5 petals. How many petals do 9 pansies have ?

**104.** At 5 dollars apiece, how much will 11 hats cost ? 7 hats ? A dozen hats ?

**105.** At $5 apiece, how many hats can be bought for $40 ? $60 ? $25 ?

**106.** At 5 cents apiece, how many oranges can be bought for 30 cents ? 45 cents ? 20 cents ? 55 cents ?

**107.** Find sums :          **108.** Find differences :

| $3.15 | $11.55 | $11.15 | $29.65 | $69.57 | $58.58 |
|-------|--------|--------|--------|--------|--------|
| 6.75  | 38.57  | 67.25  | 13.17  | 32.85  | 12.95  |
| 5.76  | 24.55  | 16.75  |        |        |        |

**109.** Add 3 thousand 2 hundred 86 to 9 thousand 3 hundred 74.

**110.** From 5 thousand 3 hundred 24 take 2 thousand 1 hundred 95 and mark the subtrahend.

**111.** Anna bought some groceries for her mother. She paid $1.15 for tea, $3.37 for flour, and $1.25 for sugar. How much was the whole bill?

**112.** Mr. Williams paid a doctor's bill of $15.75. He gave 4 five-dollar bills. How much change should he receive?

**113.** Make story problems about buying.

**114.** Name the multiples of 5 that are even numbers. What figure does each of the even multiples of five end in?

**115.** Name the multiples of 5 that are odd numbers. What figure do they end in?

**116.** Write the odd multiples of 5 in a horizontal line. Think how the number table of five looks, and write the multiples of 5 that are even numbers in a horizontal line under the line you have just written. Leave space between the lines as in the number table.

**117.** Write in Roman notation all the multiples of 5 up to 100.

**118.** M stands for 1000 in Roman notation. Write in Arabic notation MC, MCCC, MD, MDC, MDCCC, MDCCCC, MDCCCLIX.

**119.** Write in Roman notation 1800, 1830, 1840, 1850, 1860, 1890, 1896, 1861, 1876, 1883.

**120.** Write in Roman notation the number of the page on which you are reading; the number of the page on which the 7th chapter of this book begins; the number of the page on which the 12th chapter begins.

# CHAPTER VIII

## ELEVENS

**1.** Add: 11
11
——

11
11
11
——

How many units in each answer?
How many tens?

**2.** Add: 11
11
11
11
——

11
11
11
11
11
——

How many units and how many tens in each answer?

**3.** Write 9 elevens and find their sum.

**4.** Find the sum of 7 elevens. 10 elevens.

## NUMBER TABLE

| 1 | **11** | 21 | 31 | 41 | 51 | 61 | 71 | 81 | 91 |
|---|---|---|---|---|---|---|---|---|---|
| 2 | 12 | **22** | 32 | 42 | 52 | 62 | 72 | 82 | 92 |
| 3 | 13 | 23 | **33** | 43 | 53 | 63 | 73 | 83 | 93 |
| 4 | 14 | 24 | 34 | **44** | 54 | 64 | 74 | 84 | 94 |
| 5 | 15 | 25 | 35 | 45 | **55** | 65 | 75 | 85 | 95 |
| 6 | 16 | 26 | 36 | 46 | 56 | **66** | 76 | 86 | 96 |
| 7 | 17 | 27 | 37 | 47 | 57 | 67 | **77** | 87 | 97 |
| 8 | 18 | 28 | 38 | 48 | 58 | 68 | 78 | **88** | 98 |
| 9 | 19 | 29 | 39 | 49 | 59 | 69 | 79 | 89 | **99** |
| 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |

**5.** Begin at 11 and count by elevens until you reach 99. How many multiples of eleven are there in the first hundred numbers? Learn them.

**6.** Begin at 99 and count backwards by elevens rapidly.

**7.** Fill out and learn the table beginning "Once 11 is eleven," and ending "12 times eleven are 132."

**8.** What is the third multiple of 11? 5th? 8th? 6th?

Call attention to the fact that the 3d multiple of 11 is expressed by two 3's, the 5th multiple by two 5's, etc.

**9.** How many elevens in 44? 66? 77? 33? 121?

**10.** 11 multiplied by $5 = ?$ $11 \times 8 = ?$ $11 \times 4 = ?$

**11.** Add two elevens to 33. 55. 22. 77. 44. 66.

**12.** How many elevens must be added to 22 to equal 55? 44? 66? 88?

**13.** Take 2 elevens from 77. From 44. 88. 22. 66.

**14.** How many elevens can be taken from 99? From 132? 110?

**15.** How many elevens must be taken from 77 to leave 44? 22? 55? 33? 66?

**16.** How many elevens must be taken from 55 to leave 4 elevens?

**17.** Name multiples of 11, and take elevens from them.

**18.** If you had 22 cents and your mother gave you 11 cents, how many cents would you have? How many dimes and cents?

**19.** Mary had 44 cents, Julia had 11 cents more than Mary. How many cents did Julia have?

**20.** Eight boys gave 11 cents apiece toward a picnic. How many did they all give?

**21.** John solved 11 problems on Monday and twice as many on Tuesday. How many on both days?

**22.** Make problems with the number 11.

**23.** Which is the greater, 57 or 5 elevens, and how much?

**24.** Which is the greater, 6 tens or 5 elevens, and how much?

**25.** Which is the greater, 11 fives or 5 elevens, and how much?

**26.** How much does 42 lack of being as great as 4 elevens?

**27.** How much does 58 lack of being as great as 6 elevens?

**28.** 26 is how many more than 2 elevens?

**29.** 91 is how many less than 9 elevens?

**30.** 49 is how many less than 5 elevens?

**31.** 6 elevens $-7=$? 7 elevens $-8=$? 4 elevens $-9=$?

For a class exercise let the children choose numbers and tell how much they exceed or fall short of multiples of 11.

**32.** Find the third multiple of 11, take 3 from it, and tell how many tens in the answer.

**33.** Find the 5th multiple of 11, take 5 from it, and tell how many tens in the result.

**34.** Name the first multiple of 11, subtract 1, and tell how many fives in the result.

**35.** Find the second multiple of 11, subtract 2, and tell how many fives in the result.

**36.** Add 5 to the 4th multiple of 11. Add 7 to the 6th multiple of 11.

**37.** How many elevens does it take to equal the number that is the 3d multiple of 11? The 5th multiple of 11?

**38.** Think of different multiples of 11, and tell how many tens and how many units in each.

**39.** If a cow gives 11 qt. of milk each day, how many qt. will she give in a week? In 10 days?

**40.** If it takes 11 buttons for a boy's suit, how many buttons will it take for 4 suits? 7 suits? 9 suits?

**41.** If 11 cents were given to each of 5 boys, how many cents would all get?

**42.** When tops are 11 cents apiece, how much will 4 tops cost? 8 tops? 11 tops?

**43.** If 33 cents were divided equally among 3 boys, how many cents would each receive?

**44.** If 55 cents were divided equally among 5 boys, how many cents would each receive?

**45.** Of what number is 11 one half? 11 is $\frac{1}{3}$ of what? $\frac{1}{4}$ of what? $\frac{1}{7}$ of what? $\frac{1}{9}$ of what? $\frac{1}{6}$ of what?

**46.** 11 is what part of 33? Of 77? 44? 99? 55?

**47.** How much is $\frac{1}{3}$ of 33? $\frac{2}{3}$ of 33 = ?

**48.** Mr. Smith had $33 and spent $\frac{2}{3}$ of them. How many dollars did he spend? How many had he left?

**49.** How much is $\frac{1}{5}$ of 55? $\frac{2}{5}$ of 55 = ? $\frac{3}{5}$ of 55 = ?

**50.** 55 cents $- \frac{1}{5}$ of 55 cents = ? 55 cents $- \frac{2}{5}$ of 55 cents = ? 55 cents $- \frac{3}{5}$ of 55 cents = ?

**51.** Make story problems about fifths of 55.

**52.** How much is $\frac{1}{7}$ of 77? $\frac{2}{7}$ of 77 = ? $\frac{3}{7}$ of 77 = ? $\frac{5}{7}$ of 77 = ? $\frac{4}{7}$ of 77 = ? $\frac{6}{7}$ of 77 = ?

**53.** Make story problems about sevenths of 77.

### CHART DRILLS

1st. Taking some multiple of 11 as a basis, as for instance 55, point to that and let the children give the numbers that are equal to $\frac{3}{5}$ of it, $\frac{2}{5}$ of it, $\frac{5}{5}$ of it, $\frac{8}{5}$ of it, etc.

2d. Taking a multiple of 11, as 55, as a basis, let the children point to some other multiple, as 33, and tell quickly what part of 55 33 equals.

Use these drills frequently until the children can give the ratios of the multiples at sight.

**54.** 2 times 11 qt. = how many gal. and qt.?

**55.** 4 times 11 pk. = how many bu.?

**56.** 3 times 11 ft. = how many yd.?

**57.** 5 times 11 days + 1 week = how many days?

**58.** Take 2 elevens from each of the odd numbers in the third ten.
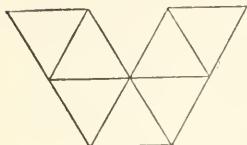


FIG. 1

**59.** Copy Fig. 1 by placing equilateral triangles. How long would the perimeter of the figure be if the side of each triangle were 11 in. long? 5 in.?



FIG. 2

**60.** Copy Fig. 2 by placing equilateral triangles. Which is greater, Fig. 1 or Fig. 2? Which has the longer perimeter?

**61.** How long would the perimeter of Fig. 2 be if each side of the triangle were 10 in.? 5 in.? 11 in.?

**62.** Place 7 equilateral triangles, making a figure different from those in the book, and make problems about the perimeter of the figure.
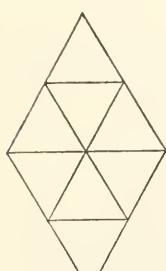


FIG. 3

**63.** Place equilateral triangles as in Fig. 3, and find how long the perimeter of the figure would be if each side of the triangle were 11 in. long.

**64.** Show $\frac{1}{2}$ of the figure you have made. Show $\frac{1}{8}$ of it; $\frac{3}{8}$; $\frac{5}{8}$; $\frac{7}{8}$; $\frac{8}{8}$.

$\frac{7}{8} - \frac{5}{8} = ?$    $\frac{7}{8} - \frac{2}{8} = ?$    $\frac{8}{8} - \frac{3}{8} = ?$    $\frac{1}{2} =$ how many eighths?

**65.** Can you separate the figure into 4 equal parts shaped just like the figure itself, only smaller? How many eighths in each of those? $\frac{1}{4} =$ how many eighths?

**66.** Place 8 equilateral triangles in such a way as to make a figure different from Fig. 3, and make problems about them.

**67.** Copy Fig. 4 by placing equilateral triangles. How many triangles in Fig. 4? How many triangles would it take to make 9 such figures? 7 such figures? 5 such figures? 8 such figures?
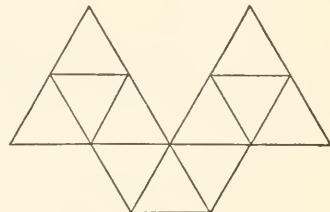
FIG. 4

**68.** How many such figures could be made from 44 equilateral triangles? From 99 equilateral triangles? From 33 equilateral triangles? From 66 equilateral triangles?

**69.** Draw a horizontal line 11 in. long, marking the inches. 1 inch is what part of it? 2 in. is what part of 11 in.? 3 in. is what part of 11 in.? 5 is what part of 11? 7 is what part of 11?

**70.** Draw a line that is $\frac{10}{11}$ as long as an 11-inch line. Draw a line that is $\frac{12}{11}$ as long as an 11-inch line.

**71.** $\frac{11}{11} - \frac{3}{11} = \frac{?}{11}.$ $\qquad$ $\frac{11}{11} - \frac{9}{11} = \frac{?}{11}.$ $\qquad$ $\frac{9}{11} - \frac{7}{11} = \frac{?}{11}.$
Let these subtractions be shown objectively if necessary.

**72.** How many players in 4 football teams? In 9 football teams?

**73.** Write in Roman notation all the multiples of 11 that are less than 135.

**74.** A string 77 in. long can be cut into how many strings 11 in. long?

**75.** Make a drawing of two rows of squares, 11 squares in a row, and tell how many squares in it.

**76.** Make 3 rows of 11 squares each, and tell how many squares there are. Find the middle square of the middle row and write the first letter of your name in it.

**77.** What is the quotient of 44 divided by 11 ?

**78.** $55 \div 11 = ?$    $\frac{77}{11} = ?$    $\frac{99}{11} = ?$    $\frac{66}{11} = ?$    $\frac{33}{11} = ?$
See note after Ex. 88, p. 111.

**79.** Show by grouping numbers on the number table how many twos equal 2 elevens; how many fives equal 5 elevens.

**80.** Write the multiples of 11 in the same position that they have in the number table.

**81.** Multiply  11  11  11  11  11  11  11
       by   2   3   6   5   7   9   8

Lead the children to see that they can get the same result by multiplying the units and then the tens as by combining numbers on the number table, and in an easier way.

**82.** Multiply  111  112  113  211  131  142  111
        by    3    4    2    3    3    2    8

**83.** When one number is multiplied by another, the result is called a **Product**. What is the product of 111 and 4 ?

**84.** Find the product of 121 and 3 ; 221 and 4 ; 122 and 3 ; 512 and 3 ; 512 and 4.

**85.** If one side of a square were 321 ft. long, how long would the perimeter of the square be ?

**86.** If each side of an equilateral triangle were 133 ft. long, what would be the length of the perimeter of the triangle ?

**87.** Multiply  35    It is left for the teacher to show that the
        by    4    two tens obtained by multiplying the 5 units
             ----   by 4 must be added to the 12 tens obtained
             140   by multiplying the 3 tens by 4.

**88.** Find products: 
| 125 | 152 | 251 | 215 | 255 | 515 |
|---|---|---|---|---|---|
| 4 | 8 | 7 | 6 | 5 | 9 |

**89.** Multiply 555 by each of the numbers that are greater than 1 and less than 10.

**90.** Multiply 2222 by each of the numbers greater than 1 and less than 10.

**91.** Add 413 to itself and see if the sum is 826.

**92.** Add 312 to itself and 312 to their sum, and see if the answer is 936.

**93.** Add 121 to 121, and keep on adding 121 until you have 484.

**94.** Add 211 to 211, and keep adding 211 until you get 1055. How many 211's does it take to make 1055?

**95.** Can you find a better way of finding the sum of five 211's than by adding them? If not, ask your teacher.

**96.** Find the sum of three 125's. Four 215's. Six 512's. Five 511's.

**97.** Write the 5th multiple of 11, under it the 7th multiple of 5, under it the 10th multiple of 2, under that the 6th multiple of 10, and add.

**98.** Write the first odd number in the 4th ten, under that the last even number in the 4th ten, under that the first odd number after 30, under that the first odd number after 37, and find their sum.

**99.** Thomas paid $8.25 for a suit of clothes, $1.25 for some handkerchiefs, $.37 for a necktie, and $.25 for some collars. How much was the whole bill?

**100.** He gave the clerk a ten-dollar bill and a five-dollar bill. How much change should he get?

**101.** How much will 7 horses cost at $125 apiece?

**102.** Tell what these words mean: *Sum, Difference, Product, Quotient.*

# CHAPTER IX

## NINES

MULTIPLIER, SQUARE YARD, SQUARE OF A NUMBER, DIVISOR

### NUMBER TABLE

| 1 | 11 | 21 | 31 | 41 | 51 | 61 | 71 | **81** | 91 |
|---|----|----|----|----|----|----|----|----|----|
| 2 | 12 | 22 | 32 | 42 | 52 | 62 | **72** | 82 | 92 |
| 3 | 13 | 23 | 33 | 43 | 53 | **63** | 73 | 83 | 93 |
| 4 | 14 | 24 | 34 | 44 | **54** | 64 | 74 | 84 | 94 |
| 5 | 15 | 25 | 35 | **45** | 55 | 65 | 75 | 85 | 95 |
| 6 | 16 | 26 | **36** | 46 | 56 | 66 | 76 | 86 | 96 |
| 7 | 17 | **27** | 37 | 47 | 57 | 67 | 77 | 87 | 97 |
| 8 | **18** | 28 | 38 | 48 | 58 | 68 | 78 | 88 | 98 |
| **9** | 19 | 29 | 39 | 49 | 59 | 69 | 79 | 89 | **99** |
| 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | **90** | 100 |

**1.** Begin with 9, and learn to count quickly by nines to 99.

**2.** Learn the multiples of 9 that are less than 100. How many are there? What is the next multiple of 9?

**3.** Begin with 108 and count backwards by nines to 0.

**4.** Fill out and learn the table of nines ending with 12 times 9 = 108.

Lead the children to see that as 9 falls 1 short of 10, 2 nines fall 2 short of 2 tens, 3 nines fall 3 short of 3 tens, and so on. Will not some child discover that in each of the first ten multiples of 9 the sum of the digits is 9?
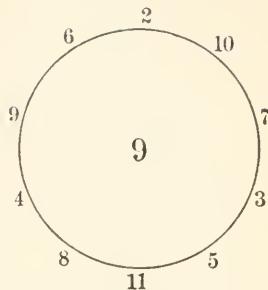
5. What is the 4th multiple of 9? 6th? 8th? 9th?

6. How many nines in 63? 81? 45? 99? 54? 36?

7. $72 + 9 = ?$   $54 + 2$ nines $= ?$   $81 + 2$ nines $= ?$

8. $63 - 2$ nines $= ?$   $36 - 2$ nines $= ?$   $81 - 2$ nines $= ?$

9. By what number must 9 be multiplied to give the product 81? 36? 63? 108? 54? 72? 99? 45? 18?

10. Multiply

| Multiply | 29 | 119 | 119 | 219 | 259 | 295 | 295 |
|---|---|---|---|---|---|---|---|
| by | 3 | 3 | 4 | 5 | 6 | 7 | 8 |

11. A number that is used to multiply another number is called a **Multiplier**. Name the multipliers in Ex. 10.

12. Use 4 as a multiplier of 99.

13. Use 5 as a multiplier of 999.

14. Use 6 as a multiplier of 9999.

15. How many nines must be added to 27 to equal 45? 36? 54? 72? 63?

16. How many nines must be taken from 72 to leave 54? 63? 45? 27?

17. How many nines must be taken from 54 to leave 5 nines? 3 nines?

18. How many nines must be taken from 45 to leave 2 nines? 4 nines?

**19.** Write in Roman notation all the multiples of 9 that are less than 109.

**20.** Which multiple of 9 is 99 ?  36 ?  63 ?  27 ?  72 ?

**21.** Draw 3 rows of squares, 9 squares in a row. Keep on adding rows of squares until you have as many rows as there are squares in a row. How many squares in all ?

**22.** If a rectangle is just as long as it is wide, it is a perfect square. Is your drawing a perfect square ? Find the middle square and make the sign of multiplication in it.

**23.** Place 4 squares so as to make a perfect square. How long is one side?

**24.** Place 9 squares so as to make a perfect square. How long is the perimeter?

**25.** Place 4 rows of squares, 4 squares in each row. How many squares in all? Is the figure a perfect square?

**26.** If you place 4 rows of squares, 5 squares in a row, will the figure be a perfect square? If not, what can be added to it to make it a perfect square? What can be subtracted from it to leave a perfect square?

**27.** How many square inches in a square whose sides are each 5 in. ?  2 in. ?  10 in. ?  9 in. ?  11 in. ?

**28.** John may draw on the floor a square, a side of which is 3 ft. long, and mark it off into square feet. How many square ft. in it?

**29.** A square measure which is 3 ft. long and 3 ft. wide is called a **Square Yard.** How many square feet make a square yard?

**30.** How many square ft. in 4 sq. yd. ?  In 7 sq. yd.? 3 sq. yd. ?  11 sq. yd. ?  5 sq. yd. ?  8 sq. yd. ?  2 sq. yd. ? 9 sq. yd. ?  6 sq. yd. ?  12 sq. yd. ?

**31.** How many square yards in 36 sq. ft. ? In 54 sq. ft. ? 99 sq. ft. ? 45 sq. ft. ? 108 sq. ft. ? 27 sq. ft. ?

**32.** 1 square foot equals what part of a square yard?

**33.** What fraction of a sq. yd. is 2 sq. ft. ? 3 sq. ft. ? 5 sq. ft. ? 8 sq. ft. ? 6 sq. ft. ?

**34.** Show $\frac{1}{3}$ of the square yard drawn on the floor. How many ninths does it equal?

**35.** Show $\frac{2}{3}$ of the square yard and tell how many ninths it equals.

**36.** Multiply 9 by itself.

**37.** When a number is multiplied by itself, the result is called the **Square** of that number. What is the square of 9? 2? 10? 5?

**38.** Add the square of 2 to the 7th multiple of 9.

Exercises like the following are useful : "Take the square of 5, add 5, take $\frac{1}{3}$, add 5, take $\frac{1}{3}$, square, add the square of 2, subtract 10, add 1, divide by 10, add the second multiple of 5, take $\frac{1}{2}$, add the square of 3," etc.

**39.** Copy Fig. 1 by placing equilateral triangles. If a side of each of the triangles you use were 9 in. long, how long would the perimeter of your figure be?

**40.** Find the length of the perimeter of the figure when each side of the small triangles is 5 in. 10 in.



FIG. 1

**41.** How many small triangles in the large triangle that you have made?

**42.** How many triangles in 6 such figures? In 8 such figures? 11 such figures? 4 such figures? 7 such figures? 9 such figures? 10 such figures? 5 such figures?
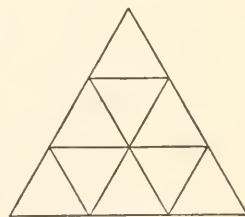
**43.** How many figures like that you have made could be made from 18 small triangles? From 72 small triangles? 54? 99? 63? 36? 81? 45? 27?

**44.** Show $\frac{1}{9}$ of the figure you have made. Show $\frac{2}{9}$ of it. Show $\frac{7}{9}$ of it. Show $\frac{9}{9}$ of it.

**45.** $\frac{9}{9} - \frac{2}{9} = \frac{?}{9}$. $\frac{8}{9} - \frac{3}{9} = ?$ $\frac{6}{9} - \frac{3}{9} = ?$ $\frac{7}{9} - \frac{5}{9} = ?$



FIG. 2

**46.** Separate your figure into thirds as in Fig. 2. How many ninths in each third ?

**47.** $\frac{1}{3}$ = how many ninths ? $\frac{2}{3}$ = how many ninths ?
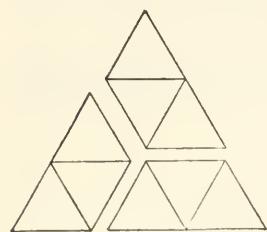
**48.** 1 is what part of 9 ? 2 is what part of 9 ? 4 is what part of 9 ? 5 is what part of 9 ? 8 is what part of 9 ? 9 is how many ninths of 9 ? 3 is what part of 9 ? 6 is what part of 9 ?

**49.** 2 times 9 ft. = how many yd.?

**50.** 3 times 9 sq. ft. = how many sq. yd.?

Children sometimes fail to distinguish linear yards and square yards. Whenever their imagery of these becomes confused or indefinite, refer them to the actual figures drawn on the floor.

**51.** 4 times 9 sq. ft. = how many sq. yd.?

**52.** 2 times 9 pk. + 6 pk. = how many bu.?

**53.** 3 times 9 qt. − 7 qt. = how many gal.?

**54.** Write all the multiples of 9 that are odd numbers less than 100.

**55.** Write all the even multiples of 9 that are less than 108.

**56.** Write the multiples of nine from 9 to 81 in a slanting line as they are in the number table.

**57.** Add 5 to the 4th multiple of 9.

**58.** Subtract the square of 2 from the 2d multiple of 9.

**59.** Subtract 5 from the 6th multiple of 9.

**60.** Subtract 3 twos from the 3d multiple of 9.

**61.** Subtract 11 from the 6th multiple of 9.

**62.** Subtract 2 elevens from the 5th multiple of 9.

Let class prepare similar questions.

**63.** If there are 9 desks in each row and 6 rows in a schoolroom, how many children can have desks of their own?

**64.** 8 children give 9 cents each to a Children's Aid Society. How many are given by all?

**65.** 11 children give $.09 apiece for a trip to the country. How much do they all give?

**66.** The fare to Chicago from a certain city in Wisconsin is $9. How much will it cost 8 persons to make the trip?

**67.** A round trip ticket to Chicago from a town in Wisconsin costs $9. How much will it cost for 7 persons to go to Chicago and back?

**68.** If a grown person's ticket costs twice as much as a child's, how much will it cost for little Mary and her mother to make a journey to Atlanta when Mary's fare is $9?

**69.** If a boy's suit cost $9, how much will 10 such suits cost?

**70.** If a dressmaker receives $9 for making a dress, how much will she earn by making 11 such dresses? 7? 4?

**71.** If a man earns 9 dollars in a week, how much will he earn in 7 weeks? 9 weeks? 12 weeks? 6 weeks?

**72.** If 18 cents are divided equally between two boys, how many cents will each boy receive?

**73.** If a ball costs 9 cents, how many balls can be bought for $.27? $.63? $.36? $.81? $1.08?

**74.** What is the quotient of 45 divided by 9 ? $36 \div 9 = ?$ $\frac{54}{9} = ?$   $72 \div 9 = ?$   $\frac{63}{9} = ?$   $\frac{99}{9} = ?$

See note after Ex. 88, p. 111.

**75.** Which is greater and how much, 3 nines or 28 ? 34 or 4 nines ?   58 or 6 nines ?   55 or 7 nines ?

**76.** 8 nines are how many more than 70 ?   How many less than 80 ?

**77.** 5 nines — 4 = ?   7 nines — 5 = ?   6 nines — 7 = ?

**78.** How much does 61 lack of being equal to 7 nines ?

**79.** How much do 5 nines lack of being equal to 48 ?

**80.** How much do 6 nines lack of being equal to 6 tens ?

**81.** 3 tens — 3 nines = ?   5 elevens — 5 nines = ?

**82.** How many nines and how many over in 28 ?   38 ?

**83.** Choose numbers less than 100 that are not multiples of 9, and tell how many nines in them and how many over.

**84.** Turn to the number table of 9 and the number table of 5, and show which is greater, 5 times 9 or 9 times 5.

**85.** Compare $9 \times 11$ and $11 \times 9$.   $9 \times 10$ and $10 \times 9$. $9 \times 2$ and $2 \times 9$.

**86.** What is the product of 90 multiplied by 4 ?   By 7 ?

**87.** Give the product of 9 multiplied by 20.   30.   40.

**88.** How much is $\frac{1}{2}$ of 9 ?   1 nine and $\frac{1}{2}$ of 9 ?

**89.** What is the product of 9 multiplied by $5\frac{1}{2}$ ?   $2\frac{1}{2}$ ?

**90.** Show on the number table the product of 9 by $1\frac{1}{3}$. By $3\frac{1}{3}$.   $8\frac{1}{3}$.   $6\frac{1}{3}$.   $4\frac{1}{3}$.   $10\frac{1}{3}$.   $7\frac{1}{3}$.   $9\frac{1}{3}$.   $5\frac{1}{3}$.   $2\frac{1}{3}$.

**91.** What is the product of 9 by $1\frac{2}{3}$ ?   By $6\frac{2}{3}$ ?   $4\frac{2}{3}$? $2\frac{2}{3}$ ?   $8\frac{2}{3}$ ?   $10\frac{2}{3}$ ?   $7\frac{2}{3}$ ?   $5\frac{2}{3}$ ?   $3\frac{2}{3}$ ?   $9\frac{2}{3}$ ?

Give exercises like Ex. 90 and 91 until pupils are prompt in that work.   Give similar exercises on each number as it is taken up.

**92.** 9 is $\frac{1}{2}$ of what number ?   9 is $\frac{1}{3}$ of what ?   $\frac{1}{4}$ of what ? $\frac{1}{5}$ of what ?   $\frac{1}{10}$ of what ?   $\frac{1}{7}$ of what ?   $\frac{1}{6}$ of what ?

**93.** 9 is what part of 27? 54? 36? 99? 63? 81? 45?

**94.** What is $\frac{1}{3}$ of 27? How much will $\frac{1}{3}$ of a yard of ribbon cost at 27 cents a yard? How much will $\frac{2}{3}$ of a yard cost?

**95.** $\frac{1}{4}$ of 36 = ? If you have 36 marbles, and lose $\frac{1}{4}$ of them, how many marbles will you lose? How many will you have left?

**96.** Show on the number table $\frac{1}{5}$ of 45; $\frac{3}{5}$ of 45; $\frac{2}{5}$ of 45; $\frac{4}{5}$ of 45.

**97.** Tell what part of 45 is 18, 36, 9, 27.

See note on Chart Drill after Ex. 53, pp. 117, 118.

**98.** May has 36 cents. Ann has $\frac{1}{4}$ as many. How many has Ann? Louise has $\frac{3}{4}$ as many cents as May. How many cents has Louise?

**99.** John has $\frac{4}{5}$ as many marbles as James, who has 45. How many marbles has John?

**100.** Make story problems.

**101.** Fill out the following, and learn to give the statements in any order:

$\frac{1}{6}$ of 54 =                    $\frac{3}{6}$ or $\frac{1}{2}$ of 54 =

$\frac{2}{6}$ or $\frac{1}{3}$ of 54 =                    $\frac{4}{6}$ or $\frac{2}{3}$ of 54 =

$\frac{5}{6}$ of 54 =

**102.** What part of 54 is 18? 45? 36? 27?

**103.** Thomas had $\frac{5}{6}$ as much money as William, who had 54 cents. How much had Thomas?

Train pupils to give results from their memory of the ratios of numbers. When, for instance, they can recall the fact that $\frac{5}{6}$ of 54 is 45, do not have them go through the process of finding $\frac{1}{6}$ of 54, and then $\frac{5}{6}$ of it.

**104.** Make a table showing the sevenths of 63 from $\frac{1}{7}$ to $\frac{6}{7}$, like the table that shows the 6ths of 54.

Children get interesting practice for a short time from exercises like this: "Let us play that Mary has 63 cents. Louise, how many sevenths of Mary's money will you think of?" "I will think of $\frac{5}{7}$ of it, or 45 cents," replies Louise. Then other pupils "think" and give their thoughts promptly.

**105.** What part of 63 is 27? 36? 18? 54? 45?

**106.** Make a table showing the eighths of 72, and study it until you can tell quickly what part of 72 is 18, 63, 45, 54, 36, 27.

**107.** Take 81 and find $\frac{1}{9}$ of it; $\frac{3}{9}$, $\frac{7}{9}$, $\frac{2}{9}$, $\frac{5}{9}$, $\frac{8}{9}$, $\frac{4}{9}$, $\frac{6}{9}$.

**108.** What part of 81 is 18? 36? 72? 27? 63? 54? 45?

**109.** If the whole of anything costs 81 cents, how much would $\frac{2}{9}$ of it cost at that rate? How much would $\frac{8}{9}$ cost? $\frac{4}{9}$? $\frac{5}{9}$? $\frac{7}{9}$?

**110.** If the whole of anything costs 81 cents, what part of it could be bought for 9 cents? 18 cents? 36 cents? 63 cents? 72 cents? 54 cents? 45 cents? 27 cents?

**111.** Make story problems about 9ths of 81.

**112.** What is $\frac{1}{10}$ of 90? $\frac{5}{10}$ of 90? $\frac{3}{10}$ of 90? $\frac{7}{10}$ of 90? $\frac{9}{10}$ of 90? $\frac{6}{10}$ of 90? $\frac{4}{10}$ of 90? $\frac{8}{10}$ of 90?

**113.** What part of 90 is 9? 27? 18? 36? 63? 54? 45? 72? 81?

**114.** Thomas had 90 cents, James had $\frac{3}{10}$ as much money. How many cents had James? William had $\frac{7}{10}$ as much. How many had William?

**115.** If a yard of lace costs 90 cents, what part of it could be bought for 18 cents? 63 cents? 45 cents?

**116.** Make story problems about 10ths of 90.

**117.** What is the quotient when 63 is divided by 9?

**118.** A number that is used to divide another number is called a **Divisor.** Pick out the divisors: $63 \div 9 = ?$ $33 \div 11 = ?$ $\frac{30}{5} = ?$ $\frac{36}{9} = ?$

Divisor    9)36
               ——
               4    Quotient.

Explain this as a new way of expressing division.

**119.** Divide and mark divisors and quotients :

9)72     5)45     9)81     9)63     5)35     9)54     9)99

**120.** In the new way set down **27** as a dividend and some number that will exactly divide it as a divisor and write the quotient. Do the same with 25, 18, 44, 55, 40, 66, 20, 50, 70, 77.

Let pupils choose other numbers and their divisors and find quotients.

**121.** How much do five 259's equal? Six 359's?

**122.** If a piano costs $295, what will 7 pianos cost at the same price?

**123.** If there are 9 buttons on each shoe, how many buttons are there on 3 pairs of shoes?

**124.** Mrs. Smith has $11.75 and wants to buy a rocking chair that costs $15.00. How much more money must she have?

**125.** Louisa's mother had $20. She spent $4.75 for coal, $3.15 for shoes, and $8.75 for a cloak. How much had she left?

**126.** Make story problems.

**127.** How many dollars and cents are 9 times $125.59? $212.55? $213.39? $991.95? $195.59?

**128.** Write in Arabic notation MDCCCLXIX and MDCCCXLIX and find their sum.

**129.** What is a multiplier? A divisor? The square of a number? A square yard?

**130.** Show three ways of expressing division.

# CHAPTER X

## THREES

### MULTIPLICAND, PARALLEL LINES, TRAPEZOID, RHOMBUS, RATIO

1. Begin with three and count quickly by threes to 39.

2. Begin with 39 and count backwards by threes to 0.

3. Write the first 4 tens in columns, putting a square in the place of every third number, as below.

| 1 | 11 | ☐ | 31 |
|---|----|----|----|
| 2 | ☐ | 22 | 32 |
| ☐ | 13 | 23 | ☐ |
| 4 | 14 | ☐ | 34 |
| 5 | ☐ | 25 | 35 |
| ☐ | 16 | 26 | ☐ |
| 7 | 17 | ☐ | 37 |
| 8 | ☐ | 28 | 38 |
| ☐ | 19 | 29 | ☐ |
| 10 | 20 | ☐ | 40 |

4. Learn the missing multiples of 3 and write them in the squares.

5. Write and learn the table of threes as far as "12 times 3 = 36." *

6. How many threes in 33? 27? 15? 12? 18?

7. Add 3 threes to 21, 27, 18, 15, 9, 30, 24, 12.

8. Subtract 3 threes from 21, 36, 27, 18, 30, 33.

* Playing "Numbers Out," a device for learning the multiplication table, is contributed by a very successful teacher and warmly indorsed by her pupils. In Numbers Out, the children stand around the room, leaving one side of the room where there is a blackboard vacant. Beginning at one end of the class, they number themselves 1, 2, etc. In playing "Threes Out," when 3 is reached, or any multiple of 3, the child,

9. 4 threes + 2 threes = ? 11 threes − 2 threes = ?

10. How many threes must be added to 24 to equal 30 ?

11. How many threes must be taken from 21 to leave 18 ? 12 ? 9 ? 15 ?

12. What number will be equaled by adding 2 to 6 threes ? By adding 1 to 9 threes ? By subtracting 1 from 10 threes ? By subtracting 2 from 8 threes ?

Call for similar questions.

13. Multiply

| 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
|----|----|----|----|----|----|----|----|
| by 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |

14. Find products of 23 multiplied by each of the numbers from 2 to 9.

15. Use as a multiplier of 53 each of the numbers from 2 to 9.

16. A number which is multiplied is called a **Multiplicand.** Name the multiplicand in Ex. 15. In Ex. 13.

17. Use 33 as a multiplicand with each of the numbers that are greater than one and less than 10 as multipliers.

18. Show by grouping on the number table which is greater, $9 \times 3$ or $3 \times 9$, $11 \times 3$ or $3 \times 11$, $5 \times 3$ or $3 \times 5$.

Turn to number tables in advance and let pupils show the equality of $8 \times 3$ and $3 \times 8$, $7 \times 3$ and $3 \times 7$, etc.

19. Draw on the board a horizontal line 1 foot long and show how many times a 3-inch line can be measured off upon it.

instead of calling the number, says "Out." goes to the blackboard, writes his number large and bold as high as he conveniently can, and takes his stand under it. When a sufficient number of children are out, the teacher calls on them to make statements about their numbers. " I stand for 27 or 9 threes," says one. " 18 is my number. It equals 6 threes," says another. A child who in numbering around names a multiple of 3, or who says " Out " for any number that is not a multiple of 3, or who makes a wrong statement about his number, misses the game.

**20.** How many times can a 3-inch line be laid off upon a 9-inch line? Upon a 15-inch line? Upon a 27-inch line?

**21.** A 3-inch line equals what part of a 12-inch line? Of a 15-inch line? Of a 27-inch line?

**22.** 3 is $\frac{1}{5}$ of what number? $\frac{1}{3}$ of what? $\frac{1}{10}$ of what? $\frac{1}{7}$ of what? $\frac{1}{6}$ of what? $\frac{1}{9}$ of what? $\frac{1}{12}$ of what?

**23.** $\frac{27}{3} = ?$   $\frac{36}{3} = ?$   $24 \div 3 = ?$   $\frac{18}{3} = ?$   $21 \div 3 = ?$

**24.** $(3 \times 8) \div 2 = ?$ $(3 \times 6) \div 2 = ?$ $(3 \times 10) \div 5 = ?$
See note after Ex. 88, p. 111.

Give quotients:

**25.** 3)18      3)27      3)21      3)15      3)24      3)12

**26.** Write 9 as a divisor of each of the multiples of 9 that are less than 100, and give quotients.

**27.** 5 yards of ribbon are how many feet long? 4 yd.? 7 yd.? 9 yd.?

**28.** A certain room is 21 feet long. How many yards of carpet must there be in each strip that runs the whole length of the room?

**29.** Measure the length of a room and tell how many yards of carpet it would take for each strip.

**30.** John lets out 36 ft. of kite string. How many yd. of string are let out?

**31.** A rug is 12 ft. long and 9 ft. wide. How many yd. long is it? How many yd. wide? Picture it, and show how many yd. of binding it would take to go all around it. (Draw to a scale.)

**32.** Mary has a flower bed 3 yd. long and 2 yd. wide. Think how it looks, and tell how many feet of border it would take to go all around it.

**33.** If you place rows of squares, each row containing three squares, until the figure is a perfect square, how many squares will there be in it?

Let those who fail to image rightly do the actual placing or drawing of squares, but encourage imagery by excusing from objective work those who are able to give correct results without it.

**34.** How many square ft. in a square which is 3 ft. long? What do we call such a square?

**35.** How many sq. ft. in 8 sq. yd.? 4 sq. yd.? 11 sq. yd.? 9 sq. yd.? 7 sq. yd.? 12 sq. yd.?

**36.** Add the square of 3, the square of 9, and the square of 10.

**37.** If you place 3 squares in a horizontal row and add equal rows of squares until you have 18 squares, how many rows will there be?

**38.** If 24 squares are placed in the same way, how many rows will there be?

**39.** What number of cents can be divided into five equal parts each of which is 3 cents? Each of which is 11 cents?

**40.** Draw a rectangle having horizontal lines 5 inches long and vertical lines 3 inches long. Divide it into square inches, and find how many square inches there are. How many rows of square inches, and how many square inches in each row?

**41.** When lines run in the same direction, they are said to be **Parallel Lines.** Draw two parallel horizontal lines. Draw three parallel horizontal lines. Three parallel vertical lines.

**42.** Draw two parallel lines slanting downwards to the left. Draw three parallel lines slanting downwards to the right.

**43.** Show parallel lines on the door ; on the window ; on your desk.

**44.** Can you name two streets or roads that are parallel ?

**45.** Think of two fences that are parallel, and tell where they are.

**46.** How many lines in the perimeter of this figure ? Which of the lines are parallel ?

**47.** If a four-sided figure has only two parallel sides, it is called a **Trapezoid.** Draw a trapezoid like this.

**48.** Draw a trapezoid which shall be in this position.

Draw another trapezoid in this position.

Let pupils draw different kinds of trapezoids in different positions, and show parallel lines.
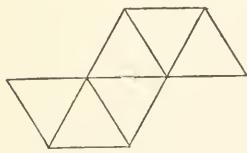
**49.** Copy Fig. 1. Can you separate the figure into two equal trapezoids ? Show $\frac{1}{6}$ of the figure. $\frac{1}{2}$ of the figure equals how many sixths ?

Fig. 1

**50.** Copy Fig. 2 by placing equilateral triangles. How many triangles in Fig. 2 ? How many triangles would it take to make 7 such figures ? To make 9 such figures ? Can you divide Fig. 2 into 3 equal trapezoids ? How many triangles in each trapezoid ?
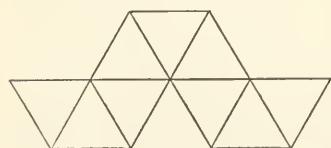
Fig. 2

**51.** Show $\frac{1}{9}$ of Fig. 2. Show $\frac{1}{3}$ of it. How many ninths in $\frac{1}{3}$ of it? Show $\frac{2}{3}$ of Fig. 2. How many ninths in $\frac{2}{3}$ of it?

**52.** How long would the perimeter of Fig. 2 be if a side of each triangle were 3 in.? How long if each side were 9 in.? If each side were 5 in.?

**53.** Copy Fig. 3 by placing triangles. How many triangles are used? How long would the perimeter of the figure be if each side of the triangles were 9 in. long? 3 in.?

**54.** Can you divide Fig. 3 into 3 equal trapezoids?

**55.** Show how many ninths in $\frac{1}{3}$ of Fig. 3. In $\frac{2}{3}$ of Fig. 3.
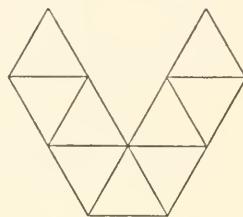
FIG. 3

**56.** Copy Fig. 4 by placing equilateral triangles. How many triangles does it take?

**57.** How long would the perimeter of the figure be if a side of each triangle were 3 in. long? 5 in. long? 9 in.?

**58.** Show $\frac{1}{2}$ of Fig. 4. Show $\frac{1}{10}$ of it. Show $\frac{3}{10}$ of it. How many tenths equal $\frac{1}{2}$ of it?

**59.** Separate Fig. 4 into 5 equal diamond-shaped figures. Each diamond is what fractional part of Fig. 4? $\frac{1}{5}$ = how many tenths?

FIG. 4

**60.** A diamond-shaped figure is called a **Rhombus.** How many sides has a rhombus? Has it any square corners?

**61.** How long is the perimeter of a rhombus, each of whose sides is 11 in.? 5 in.? 9 in.? 3 in.?
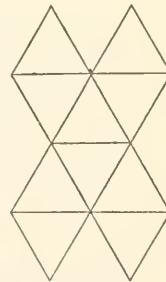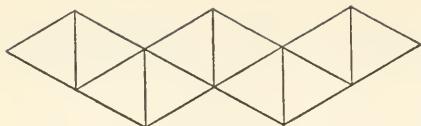
**FIG. 5**

**62.** Copy Fig. 5 by placing equilateral triangles. How many triangles in Fig. 5?

**63.** Show $\frac{1}{2}$ of the figure you have made. Show $\frac{1}{10}$ of it; $\frac{4}{10}$, $\frac{6}{10}$, $\frac{8}{10}$.

**64.** Separate your figure into 5 rhombuses. $\frac{1}{5}$ = how many tenths? $\frac{2}{5}$ = how many tenths? $\frac{3}{5}$ = how many tenths? $\frac{4}{5}$ = how many tenths?

**65.** 3 is what part of 9? 27? 36? 18? 24? 33? 21?

**66.** What is $\frac{1}{5}$ of 15? $\frac{2}{5}$ of 15? $\frac{3}{5}$ of 15? $\frac{4}{5}$ of 15?

**67.** What part of 15 is 12? 9? 3? 6?

See note on Chart Drills after Ex. 53, pp. 117, 118.

**68.** If a yd. of cloth costs $.09, how much will $\frac{1}{3}$ of a yd. cost? $\frac{2}{3}$ of a yd.?

**69.** When nuts are $.12 a pound, what part of a pound can be bought for $.03? $.09? $.06?

**70.** If a yd. of ribbon costs $.15, how much will $\frac{1}{5}$ of a yd. cost? $\frac{4}{5}$ of a yd.? $\frac{3}{5}$ yd.? $\frac{6}{5}$ yd.? $\frac{2}{5}$ yd.? $\frac{7}{5}$ yd.?

**71.** If 15 yd. of cloth cost a certain sum of money, what part of the money will 3 yd. cost? What part will 9 yd. cost? 6 yd.? 12 yd.?

**72.** How much is $\frac{1}{7}$ of 21? $\frac{2}{7}$ of 21? $\frac{4}{7}$ of 21? $\frac{6}{7}$ of 21? $\frac{3}{7}$ of 21? $\frac{5}{7}$ of 21?

**73.** What part of 21 is 3? 9? 18? 6? 15? 12?

**74.** If a yd. of ribbon costs 21 cents, how much will $\frac{2}{7}$ of a yd. cost? $\frac{6}{7}$ of a yd.? $\frac{4}{7}$ yd.? $\frac{3}{7}$ yd.? $\frac{5}{7}$ yd.?

**75.** Take 24 and show what part of it is 3, 9, 12, 6, 18, 21.

**76.** How many hours is it from 9 o'clock Monday morning till 9 o'clock Tuesday morning?

**77.** How many days from Monday morning to Wednesday morning? How many hours? From 9 o'clock to 12 o'clock is what fractional part of a day?

Refer to clock or watch.

**78.** What fractional part of a day is 6 hours? 9 hours? 15 hours? 21 hours?

**79.** From 6 o'clock in the morning to 6 o'clock at night equals how many hours? What part of a day?

**80.** From 11 o'clock in the morning until 2 o'clock in the afternoon equals how many hours? What part of a day?

**81.** From 10 o'clock in the morning till 4 in the afternoon equals what part of a day?

**82.** Take each multiple of 3 that is less than 27 and show what part it is of 27.

**83.** 3 equals what part of 30, or what is the ratio of 3 to 30?

Use these expressions interchangeably.

**84.** What is the ratio of 1 to 2? 1 to 3? 2 to 3? 1 to 5? 2 to 5? 4 to 5?

**85.** Give ratio of 3 to 9. 3 to 12. 3 to 24. 3 to 15.

**86.** What is the ratio of 9 to 27? To 81? 36? 72?

**87.** What number is $\frac{3}{10}$ of 30? $\frac{5}{10}$ of 30? $\frac{7}{10}$ of 30? $\frac{9}{10}$ of 30? $\frac{2}{10}$ of 30? $\frac{4}{10}$ of 30? $\frac{6}{10}$ of 30? $\frac{8}{10}$ of 30?

If the children try to memorize the statements of ratios without perceiving the relations of numbers, let them work out the ratios by dividing lines or grouping numbers on the number table.

**88.** What part of a yard is 3 inches? 6 in.? 18 in.? 24 in.? 33 in.? 21 in.? 15 in.? 9 in.? 27 in.?

**89.** What is the ratio of a 3-in. line to a line a yd. long?

**90.** What is the ratio of 1 to 100? 6 to 100? 10 to 100?

**91.** Point out numbers on the number table and tell their ratio to 100.

**92.** What is the ratio of a foot to a yard?

**93.** Think of a square foot, and with your finger outline in the air its perimeter.

**94.** Outline in the air a square yard. What is the ratio of a square foot to a square yard?

**95.** Show with your hands as nearly as you can the size of a pint measure; the size of a quart measure. What is the ratio of a pint to a quart? In the same way show size of inch and foot; peck and bushel; quart and gallon, and give ratios.

**96.** How much is 30 multiplied by 4? By 6? 8? 3? 9? 7?

**97.** How much is 3 multiplied by 20? By 80? 30? 90? 60? 40?

**98.** How much is 3 multiplied by $1\frac{1}{2}$? $2\frac{1}{2}$? $6\frac{1}{2}$? $8\frac{1}{2}$? $7\frac{1}{2}$? $9\frac{1}{2}$? $3\frac{1}{2}$? $5\frac{1}{2}$? $4\frac{1}{2}$? $12\frac{1}{2}$? $10\frac{1}{2}$? $11\frac{1}{2}$?

See note after Ex. 91, p. 128.

**99.** 4 times $\frac{1}{3}$ = how many whole ones and how many thirds over?

**100.** How much is 5 times $\frac{1}{3}$? 8 times $\frac{1}{3}$? 9 times $\frac{1}{3}$? 10 times $\frac{1}{3}$? 12 times $\frac{1}{3}$? 15 times $\frac{1}{3}$? 18 times $\frac{1}{3}$?

**101.** Find quotients:

$3\overline{)24}$    $3\overline{)18}$    $9\overline{)72}$    $5\overline{)30}$    $9\overline{)63}$    $9\overline{)45}$

**102.** When 4 threes are subtracted from 14 what is the remainder?

**103.** How much is the remainder when 2 threes are subtracted from 8?

**104.** Divide 10 by 3. What is the quotient and what the remainder?

**105.** Mark divisor, quotient, and remainder in the following examples:

$$\text{Divisor } 5)\overline{17}$$
$$\text{Quotient } 3, \text{ Remainder } 2.$$

$5)\overline{26}$    $9)\overline{38}$    $3)\overline{13}$    $9)\overline{19}$    $9)\overline{78}$    $5)\overline{39}$    $3)\overline{19}$    $9)\overline{65}$

**106.** When a multiple of 3 is divided by 3, is there ever a remainder? Explain.

**107.** Write all the numbers between 21 and 30 that are not multiples of 3, divide each of them by 3, and mark quotient and remainder.

**108.** Write in Roman notation the first 13 multiples of 9.

**109.** Write in Arabic notation MDCCCXCIX and MDCCCCV, and find their difference.

**110.** Find sums:        **111.** Find differences:

| $9.13 | $8.23 | $29.75 | $18.29 | $384.78 |
|-------|-------|--------|--------|---------|
| 8.23  | 2.43  | 3.83   | 12.63  | 31.96   |
| 2.13  | 6.73  |        |        |         |

**112.** John has $10.09 and wants to buy a bicycle that costs $25. How much more money must he get?

**113.** John earns $2.07 to add to his $10.09. How much does he still lack?

**114.** Some one gives him $.27. How much does he still lack?

**115.** He earns $2.18 more. How much does he still lack?

Let the children make problems in which, as in the foregoing, there is a continued striving toward some desired end.

**116.** What is meant by the words: *Multiplicand, Parallel Lines, Trapezoid, Rhombus?*

# CHAPTER XI

## EIGHTS

Denominator, Quart and Peck, Short Division, Dividend, Perpendicular Lines, Area of Right Triangle

### NUMBER TABLE

| 1 | 11 | 21 | 31 | 41 | 51 | 61 | 71 | 81 | 91 |
|---|----|----|----|----|----|----|----|----|----|
| 2 | 12 | 22 | **32** | 42 | 52 | 62 | **72** | 82 | 92 |
| 3 | 13 | 23 | 33 | 43 | 53 | 63 | 73 | 83 | 93 |
| 4 | 14 | **24** | 34 | 44 | 54 | **64** | 74 | 84 | 94 |
| 5 | 15 | 25 | 35 | 45 | 55 | 65 | 75 | 85 | 95 |
| 6 | **16** | 26 | 36 | 46 | **56** | 66 | 76 | 86 | **96** |
| 7 | 17 | 27 | 37 | 47 | 57 | 67 | 77 | 87 | 97 |
| **8** | 18 | 28 | 38 | **48** | 58 | 68 | 78 | **88** | 98 |
| 9 | 19 | 29 | 39 | 49 | 59 | 69 | 79 | 89 | 99 |
| 10 | 20 | 30 | **40** | 50 | 60 | 70 | **80** | 90 | 100 |

**1.** Count by eights to 96. How many eights did you count?

**2.** Begin with 96 and count quickly by eights back to 0.

**3.** Write and learn the table that ends with "12 times 8 are 96."

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**4.** What is the 3d multiple of 8 ?   5th ?   9th ?   6th ?
11th ?   7th ?   12th ?   8th ?   4th ?   10th ?

**5.** Which multiple of 8 is 32 ?   48 ?   64 ?   16 ?   56 ?

**6.** Give quotients:

8)16    8)48    8)64    8)80    8)56    8)32    8)72    8)24

**7.** Add 2 eights to 40.   To 64.   48.   56.   24.   16.
40 − 2 eights = ?    80 − 2 eights = ?    56 − 2 eights = ?

**8.** How many eights must be added to 24 to equal 40 ?
56 ?   72 ?   48 ?   80 ?   64 ?   88 ?   96 ?

**9.** How many eights must be taken from 80 to leave
64 ?   48 ?   32 ?   56 ?   24 ?   40 ?   16 ?

**10.** How many eights must be added to 32 to equal 9
eights ?   7 eights ?   5 eights ?   8 eights ?   6 eights ?

**11.** How many eights must be taken from 64 to leave
6 eights ?   3 eights ?   5 eights ?   4 eights ?   2 eights ?

The game " Eights Out," like that described in the footnote on
page 132, is useful.

**12.** 5 eights + 3 = ?   7 eights + 6 = ?   2 eights + 5 = ?

**13.** Find quotients and remainders :

8)28    8)75    8)50    8)71    8)39    8)53    8)47

**14.** How many must be added to 21 to equal 3 eights ?

**15.** —— may think of a number and tell how many
must be added to it to equal —— eights.

**16.** —— may think of a number and tell how many
must be subtracted from it to leave —— eights.

**17.** —— may think of a number less than 14, subtract
it from 9 eights, and tell what is left.

**18.** Is the 3d multiple of 8 even or odd ?   Can you
write a multiple of 8 that is an odd number ?

Call attention to the fact that the endings of the multiples of 8
differ by 2 in regular order, 8, 6, 4, 2, 0.

**19.** Mark products, multiplicands, and multipliers :

| 18 | 18 | 18 | 18 | 38 | 38 | 38 | 38 |
|----|----|----|----|----|----|----|----|
| 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  |

**20.** Use 28 as a multiplicand with each of the numbers that are greater than 1 and less than 10 as multipliers.

**21.** Use 5 as a multiplier with 119, 218, 318, 518, 918.

**22.** Eugene sold 3 times as many papers as his brother, who sold 28 papers. How many papers did Eugene sell? How many more than his brother ?

**23.** Use 9 as a multiplier of 181, 251, 381, 581, 881, 981.

**24.** Use 82838 as a multiplicand with each of the odd numbers that are less than 10 and greater than 1.

**25.** Use 85898 as a multiplicand with each of the even numbers that are less than 10.

**26.** What number must be used as a multiplier of 8 to produce 32 ? 24 ? 56 ? 72 ? 96? 64 ? 88 ? 48 ? 16 ?

See note after Ex. 88, p. 111.

**27.** How many sheets of paper must be divided among 5 children to give each child 8 sheets? 10 sheets? 9 sheets?

**28.** If there are 8 cherries in a bunch, how many cherries are there in 10 bunches? In 12 bunches? In 6 bunches?

**29.** If it takes 8 eggs for a cake, how many cakes can be made with 2 dozen eggs? With 48 eggs ?

**30.** Make problems using the number 8.

**31.** What is the ratio of 8 to 16 ?

Use chart drill as suggested in note after Ex. 53, pp. 117, 118.

**32.** A boy offers to trade a big apple for 16 marbles. How much of the apple ought he to give for 8 marbles?

**33.** What is the ratio of 8 to 24 ? Of 16 to 24 ?

Children should be led gradually to see such facts as that the ratio of the first multiple of any number to its second multiple is $\frac{1}{2}$; of the 2d to the 3d, $\frac{2}{3}$; of the 5th to the 10th, $\frac{1}{2}$.

**34.** Two boys receive 24 cents for cutting some wood. The big boy does $\frac{2}{3}$ of the work. How much should he receive? How much should the small boy get?

**35.** What is $\frac{1}{4}$ of 32? $\frac{3}{4}$ of 32? $\frac{2}{4}$ or $\frac{1}{2}$ of 32?

**36.** What part of 32 cents do 16 cents equal? 24 cents?

**37.** Mary has $\frac{3}{4}$ as many cents as Harriet, who has 32 cents. How many cents has Mary?

**38.** If 8 men can do a piece of work in 4 days, how long will it take 1 man to do the same work? 2 men?

**39.** What is the ratio of 8 to 40? How much is $\frac{2}{5}$ of 40? $\frac{4}{5}$ of 40? $\frac{3}{5}$ of 40?

**40.** What part of 40 is 16? 32? 24?

**41.** How many cents are $\frac{3}{5}$ of 40 cents? $\frac{2}{5}$ of \$.40?

**42.** John had 40 cents and lost $\frac{2}{5}$ of them. How many cents did he lose, and how many had he left?

**43.** $\underline{A \quad C \quad D \quad E \quad F \quad B}$. The line $AB$ represents a distance of 40 miles, divided into 5 equal parts. How far is it from $A$ to $C$? $A$ to $E$? $A$ to $D$? $A$ to $F$? $C$ to $E$? $D$ to $B$? $F$ to $B$?

**44.** What is the ratio to the whole distance of the distance from $A$ to $C$? $A$ to $F$? $F$ to $B$? $D$ to $B$? $C$ to $E$? $C$ to $F$? $A$ to $D$? $E$ to $B$?

**45.** Fill out and learn the following:

| | |
|---|---|
| $\frac{1}{6}$ of 48 = | The ratio of  8 to 48 is —— |
| $\frac{2}{6}$ or $\frac{1}{3}$ of 48 = | The ratio of 16 to 48 is —— |
| $\frac{3}{6}$ or $\frac{1}{2}$ of 48 = | The ratio of 24 to 48 is —— |
| $\frac{4}{6}$ or $\frac{2}{3}$ of 48 = | The ratio of 32 to 48 is —— |
| $\frac{5}{6}$ of 48 = | The ratio of 40 to 48 is —— |

**46.** Tell quickly what is the ratio to 48 of each of the multiples of 8 less than 48.

**47.** Three boys caught 48 fish. John caught $\frac{1}{6}$ of them, James $\frac{1}{3}$ of them, and Henry $\frac{1}{2}$ of them. How many fish did each boy catch?

**48.** Two men bought 48 bu. of apples, one man paying for $\frac{1}{3}$ of them, and the other man for the rest. How many bu. ought each man to receive?

**49.** If the apples cost $15, how much should each man pay?

**50.** Make a table showing sevenths of 56 from $\frac{1}{7}$ to $\frac{7}{7}$.

**51.** Learn to give quickly the numbers whose ratio to 56 is $\frac{5}{7}$, $\frac{3}{7}$, $\frac{6}{7}$, $\frac{4}{7}$, $\frac{2}{7}$.

**52.** If 56 marbles were divided equally among 7 children, how many marbles would 2 children receive? How many would 4 children receive? 6 children?

**53.** Albert missed 8 words in spelling 56 words. What fractional part of the words were spelled wrong? Right?

**54.** John had 56 cents and spent 16 cents. How many sevenths of his money did he spend? How many sevenths did he keep? How many cents?

**55.** Make story problems about sevenths of 56.

**56.** Draw on the board an 8-inch square and divide it into inch-squares? How many rows of squares? How many squares in each row?

**57.** How many squares in $\frac{1}{8}$ of the figure? In $\frac{3}{8}$ of it? In $\frac{5}{8}$ of it? In $\frac{7}{8}$ of it? In $\frac{1}{4}$ of it? In $\frac{1}{2}$ of it?

**58.** What part of the whole figure are 8 squares? 24 squares? 56 squares? 16 squares? 32 squares? 48 squares? 40 squares? 1 square? 7 squares? 13 squares?

**59.** Make a list of the numbers that are $\frac{1}{9}$, $\frac{2}{9}$, $\frac{3}{9}$, $\frac{4}{9}$, $\frac{5}{9}$, $\frac{6}{9}$, $\frac{7}{9}$, $\frac{8}{9}$ of 72.

**60.** Learn to give quickly the ratio to 72, of 24, 8, 48, 64, 32, 56, 16, 40.

**61.** If 72 men do a piece of work in a day, how much of it is done by 8 men? 32 men? 40 men? 64 men? 16 men?

**62.** 8 has the ratio $\frac{1}{10}$ to what number? Find $\frac{2}{10}$ of that number. $\frac{7}{10}$, $\frac{3}{10}$, $\frac{4}{10}$, $\frac{8}{10}$, $\frac{5}{10}$, $\frac{9}{10}$, $\frac{6}{10}$.

**63.** Give quickly the ratio to 80 of each of the multiples of 8 that are less than 80.

**64.** If a yd. of cloth costs \$.80, how much of it can be bought for \$.08? \$.16? \$.40? \$.24? \$.56? \$.64?

**65.** Make story problems.

**66.** In fractions the number that is written below the line is called the **Denominator.**

Name the denominator of $\frac{5}{7}$, $\frac{9}{10}$, $\frac{12}{5}$.

**67.** Write and read a fraction with 8 as the denominator and 7 for the number above the line.

**68.** Write and read a fraction with 8 as the denominator and some odd number for the other number.

**69.** Write and read a fraction with 9 as the denominator and some even number for the other number.

**70.** Write several fractions with 8 for the denominator and some other multiple of 8 for the number above the line. Tell what each equals.

Will not the children see that a fraction is a form of division?

**71.** Write several fractions with 9 for the denominator and a multiple of 9 for the other number, and tell what each fraction equals.

**72.** What is the value of the fraction that has 6 for its denominator and 3 for the number above the line?

**73.** What is the product of 80 multiplied by 6? 8? 11? 9? 7?

**74.** What is the product of 8 multiplied by 30? 70? 50? 90? 60? 40? 80?

**75.** What is the product of 80 multiplied by 30? 40? 90? 60? 70?

**76.** How much is 6 eights and $\frac{1}{2}$ of 8? 7 eights and $\frac{1}{4}$ of 8? 9 eights and $\frac{3}{4}$ of 8?

**77.** Louise has 8 cents, and Mary has $2\frac{3}{4}$ times as many. How many cents has Mary?

**78.** Make story problems.

**79.** How many quarts make a peck?

Use actual measurements.

**80.** How many qt. equal 3 pk.? 5 pk.? 9 pk.? 10 pk.?

**81.** Fill out and learn the table of Dry Measure.

$$\text{——— pints (pt.)} = 1 \text{ quart (qt.)}.$$
$$\text{——— quarts} \quad = 1 \text{ peck (pk.)}.$$
$$\text{——— pecks} \quad = 1 \text{ bushel (bu.)}.$$

**82.** How many quarts in 3 pk. + 7 qt.? 4 pk. + 5 qt.?

**83.** What is the ratio of a qt. to a pk.? 3 qt. to a pk.?

**84.** How many pk. and qt. in 18 qt.? 27 qt.? 33 qt.?

**85.** Find quotient: 3)36

Show the process of dividing tens and units separately. Lead the children to see that they get the same result by this process as by grouping numbers.

**86.** Find quotients:

5)55    2)28    9)99    8)88    2)242    2)264    3)336    2)226

**87.** Mary is making badges 3 inches long. How many can she make out of a piece of ribbon 63 inches long?

**88.** Among how many children can 88 cherries be divided, giving each child 4 cherries?

**89.** Find quotients and remainders:

$3\overline{)964}$   $2\overline{)245}$   $3\overline{)365}$   $2\overline{)4843}$   $9\overline{)93}$   $9\overline{)185}$   $9\overline{)276}$

**90.** Use 8 as a divisor of 489, 645, 568, 168, 327, 720.

**91.** A number which is divided by another number is called a **Dividend.** Name the dividends in Ex. 89.

**92.** With 5 as divisor use as dividends 105, 255, 458.

**93.** With 9 as divisor use as dividends 279, 364, 723.

**94.** With 8 as divisor use as dividends 643, 167, 489.

**95.** If 8 squares are placed in a row, how many rows must there be to use 40 squares? 56 squares?

**96.** If 8 squares are placed in a row, how many rows must there be to make the figure a perfect square? How many squares in the figure? What is the square of 8?

**97.** A triangle that has a square corner is called a **Right Triangle.** Draw a right triangle.

**98.** Make right triangles by bisecting an inch-square. The lines that meet to form the square corner are perpendicular to each other. How long is each of the perpendicular sides of the triangles you have made?

**99.** Place 8 triangles as in Fig. 1. If you take away the four outside triangles, what kind of a figure will be left?

**100.** What is the ratio of the figure that is left to the figure as it was at first?

**101.** To how many square in. is your copy of Fig. 1 equal.
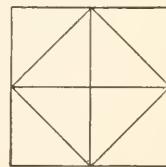
FIG. 1

**102.** Show by Fig. 1 how many eighths equal $\frac{1}{2}$; how many eighths equal $\frac{1}{4}$.

**103.** In the fraction $\frac{1}{4}$, which number is the denominator?

**104.** Copy Fig. 1 by drawing. Make each of the perpendicular sides of the triangles one inch long.

**105.** Copy Fig. 2 by placing triangles. How many such figures could you make with 24 triangles? 72? 48? 80? 96?
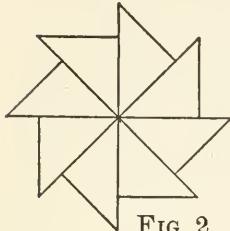
**106.** Copy Fig. 2 by drawing, making the perpendicular sides of each triangle 1 inch long. How many square inches in your copy?

FIG. 2

**107.** What is the ratio of one of the triangles to the whole figure? Of three triangles to the whole? Of 5 triangles to the whole?

**108.** How many sq. in. in a rectangle 8 in. long and 7 in. wide? 8 in. long and 5 in. wide? 8 in. long and 8 in. wide? What is a rectangle called that is as long as it is wide?

**109.** Draw two square inches, divide them into halves, and letter them as in Figs. 3 and 4. Which is greater, the triangle *ABD*, or the rectangle *EFCD*?
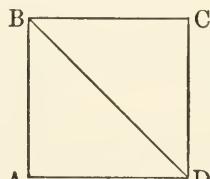
FIG. 3
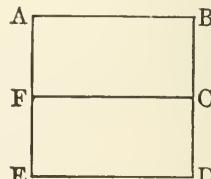
FIG. 4

Besides bringing out the fact that they are each one half of a square inch, let the equality of the figures be shown by cutting off the upper part of the triangle and fitting it to the lower part to form a rectangle, as in these figures.
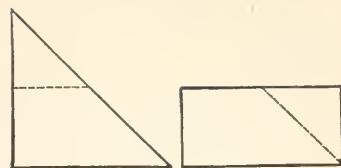
**110.** Copy Fig. 5 by drawing, making the horizontal lines 2 inches long and the vertical lines 1 inch long.

FIG. 5

**111.** How many square inches in the triangle $ADC$? In $ABC$?

Let the children prove their answers by cutting and fitting surfaces.

**112.** How many sq. in. in a right triangle 8 in. long and 3 in. wide? 8 in. long and 7 in. wide?

**113.** How many sq. in. in a triangle, one of whose perpendicular sides is 9 in. long and the other 7 in.?

**114.** What is the area of a right triangle 9 in. long and 8 in. wide?

**115.** What is the area of a right triangle 9 in. long and 6 in. wide?

**116.** When the length of the perpendicular sides of a right triangle is given, how is the area of the triangle found?

**117.** Make a trapezoid by placing 5 equilateral triangles.

**118.** Copy Fig. 6 by placing equilateral triangles. How long would the perimeter of Fig. 6 be if each side of the triangles were 8 in.? If each side were 5 in.? 11 in.? 9 in.?

FIG. 6

**119.** Can you take away 3 rhombuses from Fig. 6 and leave a trapezoid?

**120.** What is the ratio of each rhombus to the whole figure?
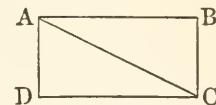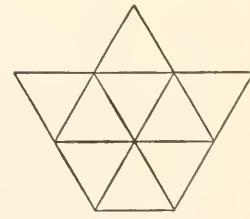
**121.** What is the ratio of the trapezoid to the whole figure?
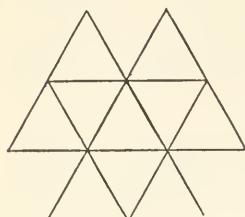
**122.** Copy Fig. 7 by placing equilateral triangles. Can you take away 3 trapezoids from the figure and leave one triangle?

FIG. 7

**123.** One trapezoid has what ratio to the whole figure? Two trapezoids have what ratio to the whole figure?

**124.** How long would each side of the triangles be if the perimeter of Fig. 7 were 12 in.? 60 in.? 96 in.?

**125.** Find quotients:

$$8)\overline{1688} \qquad 8)\overline{3288} \qquad 8)\overline{4880} \qquad 8)\overline{6488} \qquad 2)\overline{\tfrac{3\,2}{1\,6}}$$

**126.** Divide: $2)\overline{356}$
$$\overline{178}$$

Show this process of short division.

**127.** Divide:

$$3)\overline{726} \qquad 3)\overline{654} \qquad 3)\overline{9381} \qquad 3)\overline{427} \qquad 5)\overline{115} \qquad 5)\overline{275}$$

$$5)\overline{385} \qquad 5)\overline{4355} \qquad 9)\overline{828} \qquad 9)\overline{738} \qquad 9)\overline{1269} \qquad 9)\overline{1648}$$

**128.** Mr. Howe divided $2268 among 4 grandchildren. How much did each receive?

**129.** How many weeks are there in 1323 days?

**130.** What number multiplied by 8 will give 968?

**131.** Divide 187 by each of the numbers 2, 3, 5, 8, 9.

**132.** Divide 437 by 2, 3, 5, 8, 9.

**133.** Divide 493 by 2, 3, 5, 8, 9.

**134.** Divide the first odd number after 209 by 2, 3, 5, 8.

**135.** At 8 cents a qt., how much will a pk. of berries cost?

**136.** At 8 cents a qt., how much do half a pk. of berries cost?

**137.** How many ounces in $\frac{1}{2}$ a pound? In $1\frac{1}{2}$ pounds?

**138.** At 8 cents apiece, how much will a dozen pine-apples cost? How much change ought you to get from a dollar bill after paying for them?

**139.** If you bought 3 yd. of ribbon at 8 cents a yd., and gave the clerk a quarter of a dollar, how much change ought he to give you?

**140.** If you bought 6 yd. of calico at 8 cents a yd., and gave the clerk half a dollar, how much change should you get?

**141.** Anna bought 7 yd. of ribbon at 8 cents a yd., and gave the clerk a half dollar and a dime. How much change was due?

**142.** Write and add the square of 8, the square of 5, and the square of 9.

**143.** A Sunday school wishes to buy an organ which costs $125. The treasurer has $75.08. How much more is needed?

**144.** $14.23 more were paid in. How much was still needed?

**145.** After $28.13 more were paid in, how much was needed?

**146.** Mr. Brown gave $10 toward the organ. How much more was raised than the organ cost?

**147.** If the rent of a house is $22.50 a month, how much will the rent for the summer months be?

**148.** Write in Arabic notation, and divide by 8, CXV, XCV, CLXII, CCCCLIX, MDCCCXC.

**149.** Explain the words: *Denominator, Dividend, Divisor, Right Triangle, Perpendicular Lines.*

# CHAPTER XII

## FOURS

**1.** Begin with 4, and count by fours to 48.

**2.** Count by fours from 48 until nothing is left.

**3.** Write the first five tens in vertical columns, putting a square in the place of every fourth number.

| 1 | 11 | 21 | 31 | 41 |
| 2 | □ | 22 | □ | 42 |
| 3 | 13 | 23 | 33 | 43 |
| □ | 14 | □ | 34 | □ |
| 5 | 15 | 25 | 35 | 45 |
| 6 | □ | 26 | □ | 46 |
| 7 | 17 | 27 | 37 | 47 |
| □ | 18 | □ | 38 | □ |
| 9 | 19 | 29 | 39 | 49 |
| 10 | □ | 30 | □ | 50 |

**4.** Learn the missing multiples of 4, and write them in the squares.

**5.** Write and learn the table ending "12 times 4 are 48."

**6.** Name different multiples of 4, and tell whether they are even or odd.

**7.** Name the 3d multiple of 4, the 7th, 9th, 12th, 2d.

**8.** $\frac{20}{4}$? $\frac{28}{4}$? $\frac{16}{4}$? $\frac{32}{4}$? $\frac{40}{4}$? $\frac{48}{4}$? $\frac{12}{4}$? $\frac{24}{4}$? $\frac{36}{4}$?

**9.** Add 2 fours to 20, to 36, to 24, to 16, to 32.

**10.** Take 3 fours from 48, 16, 40, 32, 44, 24, 20.

**11.** $40 - 2$ fours $=$? $48 - 3$ fours $=$? $32 - 4$ fours $=$?

**12.** 8 fours $+$ 2 fours $=$? 7 fours $+$ 5 fours $=$?

**13.** 7 fours $-$ 3 fours $=$? 9 fours $-$ 4 fours $=$?

**14.** How many fours must be added to 16 to equal 28?

**15.** How many fours must be taken from 32 to leave 28? 20? 12?

**16.** How many fours must be added to 20 to equal 6 fours? 8 fours?

**17.** How many fours must be taken from 16 to leave 3 fours? 1 four?

**18.** 3 fours $+ 7 =$ ?    9 fours $- 1 =$ ?

**19.** 7 fours $+ 3 =$ ?    11 fours $- 2 =$ ?

Call for similar questions from pupils.

**20.** How many fours in 8? In 2 eights? 3 eights?

**21.** $(8 \times 3) \div 4 =$ ?    $(8 \times 5) \div 4 =$ ?    $(8 \times 6) \div 4 =$ ?

See note after Ex. 88, p. 111.

**22.** How many quarters of a dollar equal a whole dollar? How many quarters equal 3 dollars? 5 dollars? 7 dollars?

**23.** How many quarters of a dollar equal one half dollar? 1 and $\frac{1}{2}$ dollars? $2\frac{1}{2}$ dollars?

**24.** If I cut 6 apples into fourths, to how many boys can I give one fourth of an apple?

**25.** To how many boys could I give $\frac{1}{2}$ of an apple if I had 5 apples? 7 apples? 9 apples? 10 apples?

**26.** How many dollars will it take to give 20 boys a quarter of a dollar apiece? 36 boys? 48 boys? 24 boys?

**27.** How many pounds of coffee, at a quarter of a dollar a pound, can be bought for $2? For $3? For $5?

**28.** How many fourths in the whole of anything?

**29.** How many fourths in two whole things? In 4 whole ones? 3? 7?

**30.** How many fourths in 2 whole ones and $\frac{1}{4}$? In $3\frac{1}{4}$?

**31.** How many fifths in $2\frac{1}{5}$? $3\frac{2}{5}$? $5\frac{3}{5}$? $4\frac{4}{5}$? $8\frac{1}{5}$? $9\frac{3}{5}$?

**32.** Which is greater, and how much, 7 bu. or 29 pk.? 9 bu. or 34 pk.? 18 pk. or 5 bu.? 23 pk. or 6 bu.?

**33.** How many pk. in a bushel and a half? In 2 bushels and a half? In $3\frac{1}{2}$ bu.? $4\frac{1}{2}$ bu.? $5\frac{1}{2}$ bu.? $6\frac{1}{2}$ bu.?

**34.** What is the ratio of a quarter of a dollar to 2 dollars? A peck to 3 bushels? A quart to 4 gallons?

**35.** $\frac{5}{2} = ?$   *Ans.* $2\frac{1}{2}$.

**36.** $\frac{7}{2} = ?$   $\frac{11}{2} = ?$   $\frac{14}{2} = ?$   $\frac{15}{2} = ?$   $\frac{19}{2} = ?$   $\frac{13}{2} = ?$
$\frac{5}{4} = ?$   $\frac{9}{4} = ?$   $\frac{11}{4} = ?$   $\frac{13}{4} = ?$   $\frac{19}{4} = ?$   $\frac{21}{4} = ?$

**37.** Divide: 4)897   4)9893   4)827   4)7389   4)6253

Let the quotients be expressed in mixed numbers.

**38.** Divide by 4 each of the numbers between 200 and 300 whose unit figure is 7.

**39.** Use 4 as a divisor of each of the numbers between 300 and 400 whose unit figure is 5.

**40.** How many equilateral triangles in Fig. 1? Copy it by placing triangles. Can you separate your figure into three equal large triangles? Each large triangle is what fractional part of the whole figure? Each small triangle is what part of the large triangle to which it belongs?
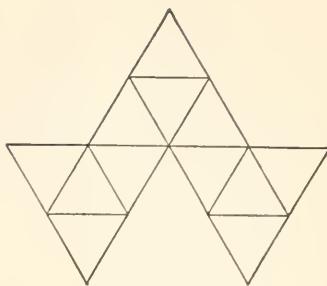


FIG. 1

**41.** How much is $\frac{1}{4}$ of $\frac{1}{3}$? How many twelfths in $\frac{1}{3}$? In $\frac{2}{3}$?

**42.** Copy Fig. 2 by placing triangles. How many triangles in it?



FIG. 2

**43.** Each triangle is what fractional part of the whole figure? Show $\frac{1}{3}$ of the figure. Show $\frac{2}{3}$ of it, and tell how many 12ths $\frac{2}{3}$ equal. Show $\frac{1}{2}$ of it, and tell how many twelfths $\frac{1}{2}$ equals.

**44.** Separate your figure into 6 rhombuses. Each rhombus is what fractional part of the whole figure? Each triangle is what fractional part of a rhombus?

**45.** $\frac{1}{6}$ = how many 12ths? $\frac{2}{6}$ = how many 12ths?
$\frac{3}{6}$ = how many 12ths? $\frac{4}{6}$ = how many 12ths?
$\frac{5}{6}$ = how many 12ths? What is $\frac{1}{2}$ of $\frac{1}{6}$?

If the children cannot see the facts which these questions are intended to bring out, do not let them memorize them. Come back to the work again with a different figure and lead them on more slowly.

**46.** Copy Fig. 2 again. Separate it into 4 equal trapezoids. Each trapezoid is what fractional part of the whole figure? Each triangle is what fractional part of a trapezoid?
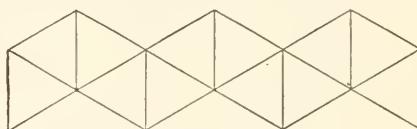
**47.**  $\frac{1}{4}$ = how many 12ths ?    $\frac{2}{4}$ = how many 12ths ?

$\frac{3}{4}$ = how many 12ths ?    $\frac{1}{3}$ of $\frac{1}{4}$ = what ?

**48.**  Put the figure together again.   Separate it into 3 equal parts.   How many triangles in each part ?

**49.**  $\frac{1}{3}$ = how many twelfths ?    $\frac{2}{3}$ = how many 12ths ? $\frac{1}{4}$ of $\frac{1}{3}$ = what ?
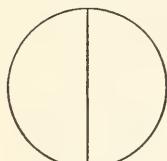


FIG. 3

**50.**  Draw a circle and draw a line across it, dividing it into halves.

Show pupils how to draw a circle by the aid of dividers or a string or a slip of pasteboard turning on a pin.
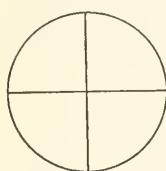


FIG. 4

**51.**  Divide each half of the circle into halves.    What is $\frac{1}{2}$ of $\frac{1}{2}$ ?
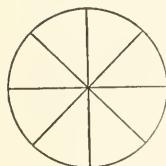


FIG. 5

**52.**  Divide each fourth of the circle into halves.    What part of the whole is $\frac{1}{2}$ of $\frac{1}{4}$ ?
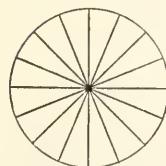


FIG. 6

**53.**  Divide each eighth of the circle into halves.   How many divisions in the whole circle ?   What part of the whole is $\frac{1}{2}$ of $\frac{1}{8}$ ?

Let these circles, large and bold, be drawn upon the board and left there for some time.   The children should discover and report from them the facts called for in the following questions, and in many similar ones.   Gradually discard this work with the concrete, and lead the pupils to the use of figures as symbols.

**54.**     $\frac{1}{2} - \frac{1}{8} = ?$        $\frac{1}{2} - \frac{3}{8} = ?$        $\frac{1}{4} - \frac{1}{8} = ?$

$\frac{1}{4} + \frac{1}{8} = ?$        $\frac{1}{2} + \frac{1}{8} = ?$        $\frac{1}{2} + \frac{1}{4} = ?$

**55.** The whole circle $-\frac{1}{16}$ = how many 16ths?

**56.**
$$\frac{1}{2} - \frac{1}{16} = ? \qquad \frac{1}{4} - \frac{1}{16} = ? \qquad \frac{1}{8} - \frac{1}{16} = ?$$
$$\frac{3}{8} - \frac{1}{16} = ? \qquad \frac{5}{8} - \frac{1}{16} = ? \qquad \frac{7}{8} - \frac{1}{16} = ?$$
$$\frac{1}{8} + \frac{1}{16} = ? \qquad \frac{3}{8} + \frac{1}{16} = ? \qquad \frac{5}{8} + \frac{1}{16} = ?$$

**57.** Name the denominators of some of the fractions in Ex. 56.

**58.** In a written fraction, the number above the line is called the **Numerator**. Name the numerators of some of the fractions in Ex. 56.

**59.** Write a fraction with an odd number for the numerator and an even number for the denominator.

**60.** Write a fraction with 4 as the numerator and 8 as the denominator, and tell what the fraction equals.

**61.** Write a fraction with 4 as the numerator and 12 as the denominator, and tell what it equals.

**62.** Write a fraction with 5 as the numerator and 10 as the denominator, and show what it equals.

**63.** Write some fractions in which the numerator is just $\frac{1}{2}$ as large as the denominator, and show what each fraction equals.

**64.** Write some fractions in which the denominator is just 3 times as large as the numerator, and show what each fraction equals.

**65.** Write some fractions with 4 as the denominator and a multiple of 4 as the numerator, and tell what each fraction equals.

**66.** What is $\frac{1}{3}$ of 12? $\frac{2}{3}$ of 12?

**67.** What is the ratio of 4 to 8? 4 to 12? 8 to 12?

Use chart drill as suggested in note after Ex. 53, pp. 117, 118.

**68.** There are 12 apples in a basket and $\frac{2}{3}$ as many on a plate. How many apples are on the plate?

**69.**  What is $\frac{1}{4}$ of 16?   $\frac{3}{4}$ of 16?   $\frac{2}{4}$ or $\frac{1}{2}$ of 16?

**70.**  What is the ratio of 12 to 16?   Of 8 to 16?

**71.**  If John has 16 marbles and James $\frac{3}{4}$ as many, how many marbles has James?

**72.**  The price of 4 marbles is what part of the price of 8 marbles?   How much will 4 marbles cost if 8 marbles cost 10 cents?  14 cents?  20 cents?  24 cents?  40 cents?

**73.**  The cost of 4 marbles is what part of the cost of 12 marbles?   How much will 4 marbles cost if 12 marbles cost 15 cents?   24 cents?   30 cents?   18 cents?

**74.**  What part of a pound is 4 ounces?   8 ounces?

**75.**  If a pound of candy costs 40 cents, what part of the money will 4 ounces cost?   How many cents will they cost?

**76.**  How much will 8 marbles cost if 16 marbles cost 10 cents?   20 cents?   30 cents?   40 cents?   50 cents?

**77.**  What is $\frac{1}{5}$ of 20?   $\frac{2}{5}$ of 20?   $\frac{4}{5}$ of 20?   $\frac{3}{5}$ of 20?

**78.**  What is the ratio of 8 to 20?   16 to 20?   12 to 20?

**79.**  If a yard of ribbon costs 20 cents, how much will $\frac{1}{5}$ of a yard cost?   $\frac{2}{5}$?   $\frac{4}{5}$?   $\frac{3}{5}$?

**80.**  If 20 men do a piece of work in a day, how much of the work is done by 4 men?   12 men?   8 men?

**81.**  If $40 is paid for the work, how much should be paid to 4 men?   12 men?   8 men?   16 men?

**82.**  Fill out and learn the following:

| | |
|---|---|
| $\frac{1}{6}$ of 24 = | The ratio of  4 to 24 is — |
| $\frac{2}{6}$ or $\frac{1}{3}$ of 24 = | The ratio of  8 to 24 is — |
| $\frac{3}{6}$ or $\frac{1}{2}$ of 24 = | The ratio of 12 to 24 is — |
| $\frac{4}{6}$ or $\frac{2}{3}$ of 24 = | The ratio of 16 to 24 is — |
| $\frac{5}{6}$ of 24 = | The ratio of 20 to 24 is — |

When these ratios can be given instantly, give and call for many illustrative problems.

**83.** How many hours in $\frac{1}{6}$ of a day ? In $\frac{5}{6}$ of a day ?

**84.** What part of a day is 12 hours ? 8 hours ?

**85.** John bought something for 24 cents and sold it so as to gain 6 cents. What was the ratio of the gain to the cost ?

**86.** Take the number 28 and make a table showing $\frac{1}{7}$, $\frac{2}{7}$, $\cdots$ $\frac{7}{7}$ of it.

**87.** Make a table showing what ratio each of the multiples of 4 less than 28 has to the number 28.

**88.** If a pound of candy costs 28 cents, how much will $\frac{2}{7}$ of it cost ? $\frac{4}{7}$ ? $\frac{6}{7}$ ? $\frac{3}{7}$ ? $\frac{5}{7}$ ?

**89.** If 28 men do a piece of work in a week, what part of it is done by 4 men ? 12 men ? 8 men ? 16 men ?

**90.** If they are paid \$14 a day, how much will 4 men receive for each day's work ? 8 men ? 18 men ? 24 men ?

**91.** Take 32 and make a table showing $\frac{1}{8}$, $\frac{2}{8}$, $\cdots$ $\frac{8}{8}$ of it.

**92.** Make a table showing the ratio to 32 of each of the multiples of 4 that are less than 33.

Require these ratios in their lowest terms.

**93.** If a pound of candy costs 32 cents, how much will $\frac{3}{8}$ of it cost ? $\frac{5}{8}$ ? $\frac{7}{8}$ ? $\frac{1}{4}$ ? $\frac{1}{2}$ ? $\frac{3}{4}$ ?

**94.** If 32 cents are paid for some candy, how much of it can be bought for 4 cents ? 12 cents ? 28 cents ?

**95.** A flower bed is 8 ft. long and 4 ft. wide. Make a picture of it. How many sq. ft. in $\frac{1}{4}$ of it ? In $\frac{3}{4}$ of it ?

**96.** Make a table showing $\frac{1}{9}$, $\frac{2}{9}$, $\cdots$ $\frac{9}{9}$ of 36.

**97.** Make a table showing the ratio to 36 of each of the multiples of 4 that are less than 38.

**98.** Mr. Smith is 36 years old. How old is his son whose age is $\frac{2}{9}$ of Mr. Smith's age ? How old is his daughter, whose age is $\frac{3}{9}$ or $\frac{1}{3}$ of her father's ? His wife's

age is $\frac{8}{9}$ of his, how old is she?  His brother's age is $\frac{5}{9}$ of his, how old is his brother?  His sister's age is $\frac{7}{9}$ of his, how old is his sister?

**99.**  A bolt of cloth contains 36 yd.  What part of it is 20 yd.?  24 yd.?  32 yd.?  16 yd.?  12 yd.?  28 yd.?

**100.**  If the whole bolt is worth $18, how much will 4 yd. cost?  8 yd.?  12 yd.?  20 yd.?  28 yd.?  32 yd.?



Fig. 7
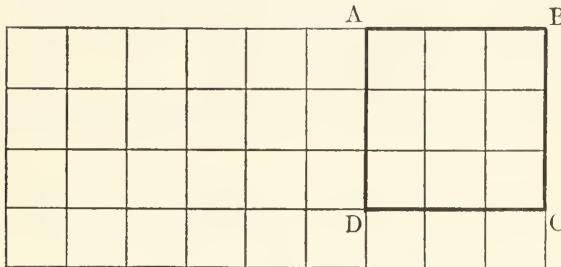
**101.** Fig. 7 represents a rectangle 9 feet long and 4 feet wide.  How many square yards are represented by *ABCD*?  Draw Fig. 7 and show how many square yards the whole figure represents.

**102.**  What is the ratio of the square, *ABCD*, to the whole figure?

**103.**  Make a table showing $\frac{1}{10}$ ··· $\frac{10}{10}$ of 40.

**104.**  Make a table showing the ratio to 40 of each of the multiples of 4 that are less than 43.

**105.**  A certain town is 40 miles from New Orleans. How far from the town is a man who has traveled $\frac{1}{10}$ of the distance from it to New Orleans?  How far is he from New Orleans?

**106.**  When he has traveled $\frac{3}{10}$ of the way to New Orleans, how far is he from the town he started from? How far is he from New Orleans?  How far is he from each place when he has traveled $\frac{5}{10}$ or $\frac{1}{2}$ of the way? $\frac{7}{10}$ of the way?  $\frac{9}{10}$ of the way?

**107.**  Find, by measuring, how many gills make a pint. How many gills in 3 pints?  5 pt.?  9 pt.?  6 pt.?

**108.** Fill out and learn the table of Liquid Measure.

—— gills (gi.) = 1 pint (pt.)
—— pints      = 1 quart (qt.)
—— quarts     = 1 gallon (gal.)

**109.** How many gi. in a qt.?   2 qt.?   5 qt.?   9 qt.?

**110.** How many gi. in $1\frac{1}{2}$ pt.?   $3\frac{1}{4}$ pt.?   $5\frac{1}{2}$ pt.? $6\frac{1}{4}$ pt.?   $7\frac{1}{2}$ pt.?   $1\frac{1}{2}$ qt.?   $4\frac{1}{2}$ qt.?

**111.** How much is 4 multiplied by 30?   20?   60? 90?   70?   50?   80?   40?   120?   150?

**112.** How much is 40 multiplied by 2?   7?   8?   12?

**113.** How much is 40 multiplied by 30?   80?   60?

**114.** How many are 3 fours and $\frac{1}{2}$ of 4?   7 fours and $\frac{1}{4}$ of 4?   9 fours and $\frac{3}{4}$ of 4?

See note after Ex. 91, p. 128.

**115.** Thomas has 4 marbles, and James has $3\frac{3}{4}$ times as many.   How many marbles has James?

**116.** Make story problems.

**117.** 5 times $\frac{1}{4}$ equals how many whole ones and fourths over?

**118.** How many whole ones and how many fourths over in 6 times $\frac{1}{4}$?   7 times $\frac{1}{4}$?   9 times $\frac{3}{4}$?   12 times $\frac{3}{4}$?   8 times $\frac{1}{4}$?   11 times $\frac{3}{4}$?   16 times $\frac{1}{4}$?   30 times $\frac{1}{4}$? 40 times $\frac{1}{4}$?   29 times $\frac{1}{4}$?   3 times $\frac{3}{4}$?   5 times $\frac{3}{4}$.

How many square inches in:

**119.** A rectangle 9 in. long and 4 in. wide?

**120.** A right triangle 9 in. long and 4 in. wide?

**121.** A rectangle 4 in. long and $2\frac{1}{4}$ in. wide?

**122.** A right triangle 4 in. long and $3\frac{3}{4}$ in. wide?

**123.** A rectangle 8 in. long and $\frac{1}{4}$ in. wide?

**124.** A right triangle 12 in. long and $\frac{1}{4}$ in. wide?

Give each child inch-cubes, and lead the class to find surfaces, edges, and angles.

**125.** Each side of a cube is called a face. How many faces has a cube?

**126.** Show some parallel lines on a cube. Show perpendicular lines.

**127.** If you were to paste a strip of paper along each edge of an inch-cube so as to bind the edges, how many inches long would all the strips be?

**128.** How many right angles has each face? How many right angles have all the faces?

**129.** Make a layer of inch-cubes 4 inches long and 2 inches wide. How many cubes in it?

**130.** Cover this layer with another layer of inch-cubes. How many cubes in the whole figure?

**131.** How many cubes would it take to build it up 3 layers high? To build it 5 layers high? 7 layers? 6 layers? 9 layers?

**132.** If it were 4 layers high, one cube would be what part of the whole figure?

**133.** Figures like these you have built are called **Square Prisms.** Build with inch-cubes a prism 5 in. long, 4 in. wide, and 2 in. high, and tell how many cubes in it.

**134.** Build a prism 3 in. long, 3 in. wide, and 2 in. high. How many layers of cubes are in it? How many cubes in each layer?

Let the children use the cubes to build prisms until they are able to get the required facts by means of their mental imagery, then encourage them to "think how it looks." Do not let illustrative work become formal nor take the place of thinking.

**135.** Find the number of cubic inches in each of the following prisms, the measurements being given in inches :

| Length | Width | Height | Length | Width | Height |
|--------|-------|--------|--------|-------|--------|
| 5 | 3 | 1 | 4 | 3 | 3 |
| 5 | 2 | 2 | 8 | 4 | 2 |
| 5 | 4 | 2 | 8 | 3 | 2 |
| 3 | 4 | 2 | 4 | 2 | 9 |

**136.** How many cubic inches in a cube each edge of which is 2 in. long?  3 in.?  4 in.?  5 in.?

**137.** How many square inches in all the faces of a 2-inch cube?  3-inch cube?  4-inch cube?  5-inch cube?

**138.** An inch cube equals what part of a 2-inch cube? What is the ratio of an inch cube to a 3-inch cube?  To a 4-inch cube?  To a 5-inch cube?

**139.** How many inch-cubes can you put into a box that measures on the inside 5 in. long, 4 in. wide, and 3 in. deep?

**140.** Estimate the length, width, and depth of a box, and tell how many cubic inches it can hold.

Let the children inclose portions of space with blocks and tell how many cubic inches in them.

**141.** How many cubic feet of air can there be in a closet that is 4 ft. long, 3 ft. wide, and 9 ft. high?

**142.** Multiply 444 by each of the numbers that are greater than 2 and less than 10.

Multiply 44
by 11
———
44
44
———
484

The process of multiplying by a number of more than one place should be shown simply as a process which brings the desired result.  Later, when the children have become expert and are ready for the insight, show them that in multiplying, for instance, 444 by 111, they are finding the sum of one hundred 444's, ten 444's, and one 444.

**143.** Find products:

| 64 | 54 | 24 | 54 | 84 | 94 |
|----|----|----|----|----|----|
| 11 | 11 | 11 | 12 | 12 | 12 |

**144.** Multiply 14 by itself.

**145.** Square 15, 21, 22, 23, 35, 38, 88, 89, 48, 49, 58, 59.

**146.** Multiply 444 by each number between 10 and 20.

Find the cost of:

**147.** 18 yd. of cloth at $1.55 a yd.

**148.** 29 hats at $1.45 apiece.

**149.** 35 pounds of tea at $1.15 per pound.

**150.** 345 tons of coal at $8.25 per ton.

**151.** There are 2000 pounds in a ton. How many pounds in 40 tons? In 70 tons? $1\frac{1}{2}$ tons? $2\frac{1}{2}$ tons?

**152.** Add:

| $4\frac{1}{2}$ | $4\frac{1}{2}$ | $3\frac{1}{4}$ | $5\frac{1}{4}$ | $6\frac{1}{4}$ | $9\frac{3}{4}$ |
|---|---|---|---|---|---|
| 2 | $4\frac{1}{2}$ | $4\frac{1}{4}$ | $7\frac{3}{4}$ | $8\frac{3}{4}$ | $8\frac{3}{4}$ |
| $4\frac{1}{2}$ | $4\frac{1}{2}$ | $5\frac{1}{4}$ | $2\frac{1}{4}$ | $6\frac{3}{4}$ | $4\frac{3}{4}$ |

**153.** Mary wants to buy for her mother a Christmas present that costs $3.00. She has $1.22. How much does she lack?

**154.** She saves $.35 more. How much does she still lack?

**155.** She earns 15 cents a week for 7 weeks. How much does she still lack?

**156.** She saves 5 cents a week for 9 weeks. Does she lack any then? If so, how much?

**157.** Find quotients:  4)3801  4)7897  9)8205

**158.** Find $\frac{1}{4}$ of 8476, 3264, 8148, 9365.

**159.** One of the girls may name a number of 5 places, and the class may use it as a dividend with 4.

**160.** Write in Arabic notation MDCCXCIX and MDCCCXLIV, and find their difference.

# CHAPTER XIII

## SEVENS

### Factors, Compound Fractions

### NUMBER TABLE

| 1  | 11 | **21** | 31 | 41 | 51 | 61 | 71 | 81 | **91** |
|----|----|--------|----|----|----|----|----|----|--------|
| 2  | 12 | 22 | 32 | **42** | 52 | 62 | 72 | 82 | 92 |
| 3  | 13 | 23 | 33 | 43 | 53 | **63** | 73 | 83 | 93 |
| 4  | **14** | 24 | 34 | 44 | 54 | 64 | 74 | **84** | 94 |
| 5  | 15 | 25 | **35** | 45 | 55 | 65 | 75 | 85 | 95 |
| 6  | 16 | 26 | 36 | 46 | **56** | 66 | 76 | 86 | 96 |
| **7**  | 17 | 27 | 37 | 47 | 57 | 67 | **77** | 87 | 97 |
| 8  | 18 | **28** | 38 | 48 | 58 | 68 | 78 | 88 | **98** |
| 9  | 19 | 29 | 39 | **49** | 59 | 69 | 79 | 89 | 99 |
| 10 | 20 | 30 | 40 | 50 | 60 | **70** | 80 | 90 | 100 |

1. Begin at 7 and count by sevens to 98. Practice until you can count quickly. How many multiples of 7 are less than 100?

2. Begin with 98 and count backwards by 7 to 0.

3. Write and learn the table ending " 12 times 7 are 84."

4. Name in order all the multiples of 7 that are less than 100 and are odd numbers.

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**5.** Name in order all the even multiples of 7 that are less than 100.

**6.** Name a few multiples of 7 greater than 100.

**7.** How many sevens in 21 ? 84 ? 42 ? 56 ? 63 ? 28 ?

**8.** Give the 5th multiple of 7 ; 7th, 9th, 11th, 4th, 6th.

**9.** Multiply 777 by each of the numbers that are greater than 45 and less than 50.

**10.** If a bicycle costs $57, how much will a dozen bicycles cost ?

**11.** At $87 apiece, what is the cost of 24 bicycles ?

**12.** At $477 apiece, how much would 13 pianos cost?

**13.** Add 2 sevens to 42, 63, 21, 49, 70, 14, 28, 56, 35.

**14.** Take 2 sevens from 77, 42, 21, 56, 84, 63, 28, 49, 35.

**15.** How many sevens must be added to 28 to make 42 ? 56 ? 70 ? 84 ? 63 ? 35 ? 49 ? 77 ?

**16.** How many sevens must be subtracted from 84 to leave 70 ? 56 ? 77 ? 63 ? 49 ? 42 ? 28 ? 14 ? 35 ?

**17.** How many sevens must be added to 21 to make 4 sevens ?  7 sevens ?  9 sevens ?  6 sevens ?  8 sevens ?

**18.** How many sevens must be taken from 77 to leave 9 sevens ?  6 sevens ?  8 sevens ?  10 sevens ?  5 sevens ?

**19.** 5 sevens + 3 = ?   8 sevens + 5 = ?   6 sevens + 6 = ?

**20.** 8 sevens − 5 = ?   11 sevens − 6 = ?   7 sevens − 5 = ?

**21.** Which multiple of 7 is 35 ? 49 ? 77 ? 21 ? 56 ? 84 ?

**22.** Add 2 to the 3d multiple of 7.   To the 6th.   10th.

**23.** Subtract 4 from the 2d multiple of 7.   From the 7th, 9th, 5th.

**24.** 50 is how many more than the 7th multiple of 7 ? How many less than the 8th multiple of 7 ?

Call for similar questions from pupils.

**25.** $\frac{21}{7} = ?$   $\frac{42}{7} = ?$   $\frac{84}{7} = ?$   $\frac{56}{7} = ?$   $\frac{35}{7} = ?$   $\frac{63}{7} = ?$
$\frac{15}{7} = ?$   $\frac{38}{7} = ?$   $\frac{66}{7} = ?$   $\frac{89}{7} = ?$   $\frac{31}{7} = ?$   $\frac{53}{7} = ?$

**26.** At 7 cents a yard, how many yards of ribbon could you buy for 15 cents? 23 cents? 29 cents? 36 cents?

**27.** Make story problems.

**28.** Divide by 7 each of the numbers between 900 and 1000 whose unit figure is 4.

**29.** At $7 apiece, how many music boxes could be bought for $500? $800? $900?

**30.** Multiply 797 by each of the even numbers between 31 and 39.

**31.** Multiply 897 by each of the odd numbers between 40 and 50.

**32.** What number must 7 be multiplied by to make a product of 56? 63? 84? 49? 42?

**33.** Numbers that make a product are called **Factors** of that product. Name two factors that make 14, 35, 77, 21, 49, 63, 84, 42, 28, 56, 70.

**34.** 8 is a factor of 24. Name the other factor that helps 8 to make 24. 4 is also a factor of 24. Name the other factor that helps 4 to make 24.

**35.** 2 is one of a pair of factors that help each other to make 24. What is the other factor?

**36.** Give all the pairs of factors that you can of 12, 18, 20, 30.

**37.** $44 = 4 \times ?$   $25 = 5 \times ?$   $28 = 4 \times ?$   $42 = 7 \times ?$

**38.** Write all the multiples of 8 that are less than 48, and the pairs of factors into which they can be divided.

Let pupils begin with the smallest factors and work regularly; as,

$$8 = 2 \times 4;$$
$$16 = 2 \times 8 \text{ or } 4 \times 4;$$
$$24 = 2 \times 12 \text{ or } 3 \times 8 \text{ or } 4 \times 6.$$

This is an excellent review of the multiplication table.

**39.** Write all the multiples of 9 that are less than 50, and give factors of them.

**40.** How many times can a 7-inch line be measured off upon a 21-inch line? Upon a line that is 2 ft. and 4 in. long? Upon a line that lacks an inch of being equal to a yard? Upon a line that lacks 4 in. of being 5 ft. long? Upon a line that is 1 yd. 1 ft. and 1 in. long?

**41.** How many rows of squares, 7 in a row, make 42 squares? 28 squares? 63 squares? 49 squares?

**42.** Place or draw 9 inch-squares so as to make a perfect square. How long is the figure? How wide is it?

**43.** Draw a square containing 49 square inches and mark them off. Give length and width of the figure.

**44.** Draw 16 inch-squares placed in a perfect square. How long is each side of the square?

**45.** Draw 25 inch-squares arranged in a perfect square. How long is each side of the square?

**46.** What is the square of 3? 4? 5? 7?

**47.** Find the square of 17; 27; 77; 97; 47.

**48.** What number, multiplied by itself, will give 9? 25? 16? 100?

**49.** Give other numbers that are made of two equal factors.

**50.** A number that is made of two equal factors is called a **Perfect Square,** and each of the equal factors is called a **Square Root** of the number. What is the square root of 49? 25? 81? 16?

**51.** Write some other numbers that are perfect squares, and give their square roots.

Oral class exercises like the following are useful: "Take the square root of 9, double it, add 4, divide by 2, square, subtract 5, take ½, add," etc.

**52.** The floor of a square room contains 49 sq. ft. How long is one side of the room? How many feet around all the edges of the floor?

**53.** How many feet around the edge of the floor of a closet if the floor is square and contains 25 sq. ft.?

**54.** How many feet around the edge of a square floor that contains 16 sq. yd.? 25 sq. yd.? 64 sq. yd.?

**55.** How many feet around a room 11 ft. long and 7 ft. wide?

**56.** How much will a pt. of oil cost at 7 cents a gi.? At 9 cents? 3 cents? 8 cents?

**57.** If it takes you 7 minutes to walk to school, how many minutes do you spend in walking to school each day? How many in a week of 5 school days? In a school month or 20 days?

**58.** At 7 cents a qt., how much will a gal. of milk cost?

**59.** How much will 3 yd. of wire cost at 7 cents a ft.? At 7 cents an in.?

**60.** 7 times 7 in. = how much more than 4 ft.?

**61.** How much will 2 qt. and 1 pt. of berries cost at 7 cents a pt.? At 14 cents a qt.?

**62.** How many apples would it take to give 6 boys 7 apples apiece?

**63.** How many marbles must you have to give 7 marbles to each of 8 boys?

**64.** How many days in 4 weeks? 5 weeks? 8 weeks? 6 weeks? 3 weeks and 4 days? 5 weeks and 1 day?

**65.** What part of a week is 1 day? 3 days? 5 days?

**66.** How many weeks and sevenths of a week in 11 days? 22 days? 30 days? 36 days? 44 days? 50 days? 69 days? 82 days?

**67.** How many weeks in 583 days?  687 days?  599 days?  1601 days?

**68.** How many inch cubes will it take to make a square prism 7 in. long, 3 in. wide, and 2 in. high?

**69.** How many cubic inches in a box 7 in. long, 4 in. wide, and 2 in. deep?

**70.** How many cubic feet of space in a closet 7 ft. long, 6 ft. wide, and 8 ft. high?

**71.** How many cubic feet of space in a closet 7 ft. square and 9 ft. high?

**72.** Arrange 7 equilateral triangles as in Fig. 1.  Can you take away two trapezoids from Fig. 1 and leave one triangle?
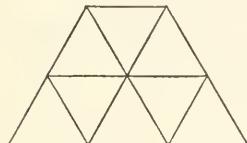
Fig. 1

**73.** What is the ratio of one triangle to the whole figure?  Of one trapezoid to the whole figure?  Of two trapezoids to the whole figure?

**74.** Copy Fig. 2.  Take away two trapezoids and show what is left.
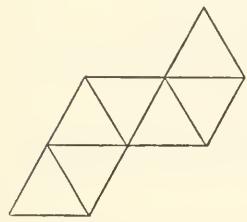
Fig. 2

**75.** Can you show how Fig. 1 may be changed into Fig. 2 by changing the position of one trapezoid?

**76.** How long would the perimeter of Fig. 2 be if each side of a triangle were 7 in.?  8 in.?  9 in.?  5 in.?  11 in.?

**77.** Take away $\frac{3}{7}$ of Fig. 2.  Tell how long the perimeter of the figure that is left would be if each side of the triangles were 7 in. long.

**78.** How many sevenths make the whole of anything?

**79.** How many sevenths in 2 whole ones?  9?  5?  7?

**80.** How many 7ths in $2\frac{1}{7}$?  $3\frac{2}{7}$?  $5\frac{3}{7}$?  $7\frac{1}{7}$?  $8\frac{3}{7}$?  $9\frac{5}{7}$?

**81.** Copy Fig. 3 by placing equilateral triangles. Each triangle is what part of Fig. 3?



FIG. 3

**82.** Divide each equilateral triangle into two right triangles as in Fig. 4. Each right triangle is what part of the whole figure? $\frac{1}{2}$ of $\frac{1}{7} = ?$



FIG. 4

**83.** Copy Fig. 5 by placing equilateral triangles. 1 triangle is what part of Fig. 5?
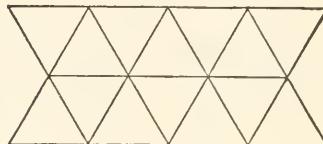


FIG. 5

**84.** Separate your copy into halves. 1 triangle is what part of a half of the figure? $\frac{1}{7}$ of $\frac{1}{2} = ?$

Show pupils that when we wish to find the value of a compound fraction, instead of dividing and subdividing an object and counting the parts, we multiply the numerators of the fractions together for a new numerator, and the denominators for a new denominator. Let them try the plan with some small fractions and prove its correctness by building figures and separating them into parts.

**85.** $\frac{1}{7}$ of $\frac{1}{3} = ?$     $\frac{1}{2}$ of $\frac{1}{3} = ?$     $\frac{1}{3}$ of $\frac{1}{4} = ?$     $\frac{1}{3}$ of $\frac{1}{5} = ?$

**86.** A fraction of a fraction is called a **Compound Fraction.** Write some compound fractions and find their values.

**87.** $\frac{1}{7}$ of $\frac{1}{9} = ?$     $\frac{1}{7}$ of $\frac{1}{8} = ?$     $\frac{1}{7}$ of $\frac{1}{10} = ?$     $\frac{1}{7}$ of $\frac{1}{6} = ?$

**88.** $\frac{1}{7}$ of $\frac{1}{3} = \frac{1}{21}$. What will $\frac{2}{7}$ of $\frac{1}{3}$ equal?

**89.** How much are $\frac{3}{7}$ of $\frac{1}{3}$?   $\frac{4}{7}$ of $\frac{1}{3}$?   $\frac{5}{7}$ of $\frac{1}{3}$?   $\frac{1}{3}$ of $\frac{1}{5}$?

**90.** $\frac{1}{4}$ of $\frac{1}{7} = ?$   $\frac{1}{4}$ of $\frac{3}{7} = ?$   $\frac{3}{4}$ of $\frac{3}{7} = ?$   $\frac{3}{5}$ of $\frac{2}{7} = ?$

**91.** $\frac{2}{3}$ of $\frac{3}{4} = ?$   (Cancel when you can.)   $\frac{5}{7}$ of $\frac{7}{10} = ?$   $\frac{3}{7}$ of $\frac{14}{9} = ?$   $\frac{5}{8}$ of $\frac{16}{20} = ?$   $\frac{3}{4}$ of $\frac{8}{9} = ?$   $\frac{4}{7}$ of $\frac{21}{24} = ?$   $\frac{5}{9}$ of $\frac{9}{10} = ?$

**92.** What is the ratio of 7 to 14?   7 to 21?   14 to 21?   28 to 21?   35 to 21?

Use chart drill.

**93.** If a yard of ribbon costs 21 cents, how much ribbon can you get for 7 cents? 14 cents? 28 cents? 42 cents?

**94.** What is the ratio of 7 to 28? 21 to 28? 14 to 28?

**95.** If 28 apples cost 10 cents, how much will 14 apples cost?

**96.** A bed of pinks 2 feet square is a part of a flower bed 7 ft. long and 4 ft. wide. Make a picture of them, drawing to a scale of 1 inch to a foot. What is the ratio of the bed of pinks to the whole flower bed?

**97.** How much is $\frac{1}{5}$ of 35? $\frac{4}{5}$? $\frac{2}{5}$?

**98.** $35 - \frac{1}{5}$ of $35 = ?$ $35 - \frac{3}{5}$ of $35 = ?$ $35 - \frac{4}{5}$ of $35 = ?$

**99.** What part of 35 is 28? 14? 21? 42?

**100.** Mary had 35 cents and spent $\frac{2}{5}$ of them. How many had she left?

**101.** Mr. Baker borrowed $35. When he had paid $\frac{3}{5}$ of it, how many dollars did he still owe?

**102.** John had 35 marbles, and Albert had $\frac{4}{5}$ as many. How many had Albert?

**103.** Mr. Lane's watch chain is worth $\frac{2}{5}$ as much as his watch, which is worth $35. How much is the chain worth? How much are they both worth? The watch is worth how much more than the chain?

**104.** Fill out and learn the following:

| | |
|---|---|
| $\frac{1}{6}$ of $42 =$ | The ratio of —— to 42 is —— |
| $\frac{2}{6}$ or $\frac{1}{3}$ of $42 =$ | The ratio of —— to 42 is —— |
| $\frac{3}{6}$ or $\frac{1}{2}$ of $42 =$ | The ratio of —— to 42 is —— |
| $\frac{4}{6}$ or $\frac{2}{3}$ of $42 =$ | The ratio of —— to 42 is —— |
| $\frac{5}{6}$ of $42 =$ | The ratio of —— to 42 is —— |
| $\frac{6}{6}$ of $42 =$ | The ratio of —— to 42 is —— |

**105.** Fill out the following table of Avoirdupois Weight:

—— ounces (oz.) = 1 pound (lb.).
—— pounds      = 1 Ton (T.).

**106.** How many oz. in 2 lb. and 3 oz.? 2 lb. 7 oz.?

**107.** A jar contains 2 lb. and 10 oz. of butter. How many oz. in the jar? How many oz. in $\frac{1}{6}$ of it? $\frac{5}{6}$ of it? $\frac{1}{3}$ of it? $\frac{2}{3}$ of it? $\frac{1}{2}$ of it?

**108.** There are 42 gal. of oil in a barrel. When $\frac{1}{6}$ of the oil is drawn out, how many gal. are left? How many are left when $\frac{2}{6}$ or $\frac{1}{3}$ of the oil is drawn out? When $\frac{4}{6}$ or $\frac{2}{3}$ is drawn out?

**109.** Grace wishes to buy a doll that costs 42 cents. She has 35 cents. What part of the price has she, and how many sixths of the price does she need?

**110.** Make a table showing the 7ths of 49 from $\frac{1}{7}$ to $\frac{7}{7}$.

**111.** Make a table showing the ratio of each multiple of 7 that is smaller than 50, to 49.

**112.** Mr. Jones can do a piece of work in 49 days. How many days will it take him to do $\frac{2}{7}$ of it? How many weeks? How many days will he need to do $\frac{5}{7}$ of it? $\frac{6}{7}$? $\frac{4}{7}$? $\frac{7}{7}$? How many weeks in each case?

**113.** There are 49 yards in a bolt of cloth. What fractional part of it remains after 7 yd. of it are sold? After 21 yd. are sold? After 35 yd. are sold?

**114.** Gertrude's age is $\frac{2}{7}$ of 49 years. Her father's age is $\frac{6}{7}$ of 49 years, and her mother's age is $\frac{5}{7}$ of 49 years. How old is each one of the family?

**115.** How much younger is Gertrude than her father? Than her mother?

**116.** Gertrude's age is in what ratio to her father's age? To her mother's age?

**117.** Make a table showing the 8ths of 56 from $\frac{1}{8}$ to $\frac{9}{8}$.

**118.** Make a table showing what ratio each multiple of 7 that is smaller than 64 has to 56.

**119.** Mary spent 56 days in a visit to her aunt at St. Louis. When she had been there a week, what part of her visit was past? What part of it was past when she had been there 21 days? 35 days? 49 days?

**120.** A farmer brought 56 lb. of butter to market and sold $\frac{7}{8}$ of it. How many lb. had he left?

**121.** He received $14 for his 56 lb.; how much did he receive for 28 lb. of it?

**122.** Anna has 56 cents. How much will she have when she has spent $\frac{1}{8}$ of it? $\frac{3}{8}$ of it? $\frac{5}{8}$ of it? $\frac{7}{8}$ of it?

**123.** Make a table showing the 9ths of 63 from $\frac{1}{9}$ to $\frac{10}{9}$.

**124.** Make a table showing what fractional part of 63 each multiple of 7 is that is less than 75.

**125.** A gentleman's house is 63 miles from Denver. When he has traveled $\frac{1}{9}$ of the way to Denver, how far is he from his own house? How far from Denver? Tell how far he is from each place when he has traveled $\frac{2}{9}$ of the way. $\frac{4}{9}$. $\frac{5}{9}$. $\frac{7}{9}$. $\frac{8}{9}$.

**126.** A garden is 63 ft. long and 42 ft. wide. What is the ratio of its width to its length?

**127.** Make a table showing 10ths of 70 from $\frac{1}{10}$ to $\frac{10}{10}$.

**128.** Make a table showing what fractional part of 70 each multiple of 7 is that is less than 75.

**129.** Arthur, William, and Thomas gave 70 cents in charity. Arthur gave $\frac{5}{10}$, or $\frac{1}{2}$, of the money, William gave $\frac{3}{10}$, and Thomas gave $\frac{2}{10}$, or $\frac{1}{5}$. How many cents did each give?

**130.** John had 14 cents, and wished to buy a 70-cent cap. What part of the cost of the cap had he? What part did he lack? What part did he lack when he had gained 21 cents more?

**131.** If one fan costs 7 cents, how many fans can be bought for 56 cents? 28 cents? 63 cents? 84 cents?

**132.** If 2 fans cost 14 cents, how much will 3 fans cost? 5 fans? 7 fans? 4 fans? 8 fans?

**133.** How much will 8 fans cost if 7 fans cost 21 cents? 63 cents? 49 cents? 84 cents? 28 cents? 56 cents?

**134.** How much will 9 fans cost if 7 fans cost 21 cents? 49 cents? 63 cents? 14 cents? 28 cents? 56 cents?

**135.** What is the product of 70 multiplied by 8? 6? 11?

**136.** What is the product of 7 multiplied by 30? 60? 90?

**137.** How much are 2 sevens and $\frac{1}{7}$ of 7? 3 sevens $+ \frac{2}{7}$ of 7?

Let pupils practice giving quickly the products found by multiplying 7 by each of the smaller integers $+ \frac{1}{7}, \frac{2}{7}, \frac{3}{7}$, etc.

**138.** How many sq. in. in a rectangle 7 in. long and $5\frac{1}{7}$ in. wide? How many in a right triangle of the same length and width?

**139.** Multiply

| | 9 | 27 | 77 | 7 | 7 | 247 | 328 |
|---|---|---|---|---|---|---|---|
| by | 10 | 10 | 10 | 100 | 1000 | 20 | 40 |

**140.** Tell how you multiply a number by 10 or 100.

**141.** Show how you multiply a number by 20, 30, or any multiple of 10.

**142.** In a right triangle one of the sides that makes the right angle is called the **Base** and the other the **Altitude**. Find the area of a right triangle whose base is 7 inches and altitude 10 inches.

**143.** By holding a paper triangle in different positions, show that the same line may sometimes be called the base and sometimes the altitude.

**144.** Draw right triangles, making the bases and altitudes of any measurements you choose, and find the areas.

**145.** Add:

| $7\tfrac{1}{7}$ | $9\tfrac{2}{7}$ | $6\tfrac{2}{7}$ | $1\tfrac{4}{7}$ | $8\tfrac{4}{7}$ | $9\tfrac{4}{7}$ | $4\tfrac{3}{7}$ |
|---|---|---|---|---|---|---|
| $4\tfrac{2}{7}$ | $4\tfrac{3}{7}$ | $3\tfrac{1}{7}$ | $1\tfrac{2}{7}$ | $3\tfrac{5}{7}$ | $1\tfrac{3}{7}$ | $9\tfrac{1}{7}$ |
| $5\tfrac{3}{7}$ | $1\tfrac{2}{7}$ | $9\tfrac{5}{7}$ | $9\tfrac{1}{7}$ | $2\tfrac{4}{7}$ | $8\tfrac{2}{7}$ | $9\tfrac{4}{7}$ |

**146.** There are $4\tfrac{3}{7}$ yards of cloth in May's dress, and $2\tfrac{4}{7}$ yards in her jacket. How many yards are there in both?

**147.**

| From | $7\tfrac{6}{7}$ | $35\tfrac{5}{7}$ | $16\tfrac{4}{7}$ | $27\tfrac{3}{7}$ | $25\tfrac{4}{7}$ | $64\tfrac{5}{7}$ | $3\tfrac{4}{7}$ |
|---|---|---|---|---|---|---|---|
| take | $4\tfrac{4}{7}$ | $17\tfrac{2}{7}$ | $9\tfrac{3}{7}$ | $9\tfrac{1}{7}$ | $1\tfrac{1}{7}$ | $2\tfrac{1}{7}$ | $1\tfrac{1}{7}$ |

**148.** For five years Mr. Smith's family saved money to raise the sum of $1000, to send John to college. The first year they saved $85.75, the second year $98.50, the third year $197.50. How much more was needed to make up the $1000?

**149.** In the fourth year they laid aside $195.45, and John's uncle sent him a check for $150. How much more was needed?

**150.** In the fifth year they saved $245.50, and John earned the rest in vacation. How much did John earn?

**151.** If a boy earns $3.95 a week, how much will he earn in 17 weeks? In 19 weeks?

What will be the cost of:

**152.** 19 tons of hay at $9.75 per ton?

**153.** 23 barrels of flour at $4.75 per barrel?

**154.** 24 copies of " Alice in Wonderland " at $1.27 per copy?

**155.** 28 bu. of wheat at $.87 a bu.?

Find cost of each article if :

**156.** 3 tons of hay cost $24.75.

**157.** 5 barrels of flour cost $26.25.

**158.** 7 geographies cost $4.55.

**159.** 9 bushels of wheat cost $8.19.

Let the children find the actual prices of various articles in common use in their locality, and bring in problems based upon them.

**160.** Name two factors of the 3d multiple of 7. Of the 5th. 9th. 11th. 8th. 6th. 3d. 7th. 12th.

**161.** Of what number is 7 the square root? How long is one side of a square that contains 49 square inches?

**162.** What number that has 7 for a factor is nearest to 20? 30? 50?

**163.** How much greater is the product of 7 and 8 than their sum?

**164.** Thomas went fishing at 7 o'clock in the morning, and came home 7 hours later. At what time did he come home?

**165.** Write in Arabic notation CCCCXXVII and VII, and find their quotient.

**166.** Write in Roman notation the present year, the year in which you were born, the year in which the Declaration of Independence was signed.

# CHAPTER XIV

## SIXES

### ROD, HEXAGON, INTEREST

#### NUMBER TABLE

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 11 | 21 | 31 | 41 | 51 | 61 | 71 | **81** | 91 |
| 2 | **12** | 22 | 32 | **42** | 52 | 62 | **72** | 82 | 92 |
| 3 | 13 | 23 | 33 | 43 | 53 | 63 | 73 | 83 | 93 |
| 4 | 14 | **24** | 34 | 44 | **54** | 64 | 74 | **84** | 94 |
| 5 | 15 | 25 | 35 | 45 | 55 | 65 | 75 | 85 | 95 |
| **6** | 16 | 26 | **36** | 46 | 56 | **66** | 76 | 86 | **96** |
| 7 | 17 | 27 | 37 | 47 | 57 | 67 | 77 | 87 | 97 |
| 8 | **18** | 28 | 38 | **48** | 58 | 68 | **78** | 88 | 98 |
| 9 | 19 | 29 | 39 | 49 | 59 | 69 | 79 | 89 | 99 |
| 10 | 20 | **30** | 40 | 50 | **60** | 70 | 80 | **90** | 100 |

1. Add 6 to 0, and keep on adding sixes until you have 12 sixes. What number have you? Which multiple of 6 is it?

2. Begin at the 12th multiple of 6 and count backwards by sixes until nothing is left.

3. Learn the table of sixes as far as "12 times 6 are 72."

180

Give rapid drill on 6's by aid of this figure.

**4.** How many sixes in 24? 42? 54? 66? 36? 48? 72? 30?

**5.** Add 2 sixes to 18. 30. 48. 60. 54. 24.

**6.** Subtract 2 sixes from 48. 60. 24. 36. 66.



**7.** How many sixes must be added to 12 to equal 30? 36? 24? 18? 42?

**8.** How many sixes must be taken from 48 to leave 5 sixes? 7 sixes? 4 sixes? 6 sixes?

**9.** Read and give quotients quickly:

$$\frac{18}{6} \quad \frac{30}{6} \quad \frac{60}{6} \quad \frac{36}{6} \quad \frac{48}{6} \quad \frac{72}{6} \quad \frac{24}{6} \quad \frac{66}{6} \quad \frac{42}{6} \quad \frac{54}{6}$$

**10.** If you put 36 square inches into a perfect square, how long would one side of the figure be? How long would the perimeter of the figure be?

**11.** Of what number is 6 the square root?

**12.** Multiply 6666 by the square root of 36; by the square root of 49; by the square root of 64; by the square root of 81.

**13.** Use 6666 as a multiplicand with each of the numbers greater than 55 and less than 63.

**14.** Use 6 as a divisor with each of the numbers between 500 and 600 whose unit figure is 9.

**15.** What factor helps 6 to make 18? 30? 54? 72? 60?

**16.** Name two numbers, neither of which is 6, that multiplied together give 18. 30. 24. 72. 12. 36.

**17.** Write as many sets of factors of 24 as you can. Of 26. 48. 30. 28. 40. 32. 20. 16.
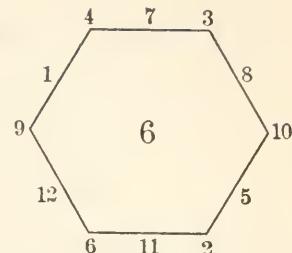
**18.**  Write the multiples of 6 as far as 72, and give the sets of factors into which they can be resolved, as:

$$6 = 2 \times 3 ;$$
$$12 = 2 \times 6 \text{ or } 3 \times 4 ;$$
$$18 = 2 \times 9 \text{ or } 3 \times 6 ;$$
$$24 = 2 \times 12 \text{ or } 3 \times 8 \text{ or } 4 \times 6.$$

Let the children select composite numbers, and call on the class for the factors of them. Factoring is very useful in helping children to see the relations of numbers, and is not difficult for them if they know the multiplication tables.

**19.**  Name some numbers that are made of two equal factors, and give the factors.

**20.**  Fill out the blanks in the following sentence: " One of the two equal factors that make a number is called the —— —— of that number."

**21.**  $15 \times 15 = 225$.  What is the square root of 225 ?

**22.**  Of what number is 16 the square root ?  21 ?  23 ? 18 ?

**23.**  How many lb. of sugar could be bought for 48 cents when sugar is 6 cents a lb. ?  8 cents a lb. ?  4 cents a lb. ?

**24.**  To how many boys could you give 6 marbles apiece if you had 36 marbles ?  66 ?  42 ?  30 ?

**25.**  If there were 6 peas in a pod, how many peas in 9 pods ?  7 ?  12 ?  8 ?  6 ?

**26.**  Mrs. Adams cut the pies at a picnic. She cut 7 pies into sixths, and they were all eaten up.  Each person had one piece of pie.  How many persons were at that picnic?

**27.**  Anna has 3 times as much money as Mary, who has 6 cents.  How much have both ?

**28.**  John has 5 times as much money as James, who has 6 cents.  How much more has John than James ?

**29.** Five boys started a game of marbles. Fred, one of the boys, had no marbles, and so each of the other boys lent him 6 marbles. How many had Fred to start with?

**30.** Fred won 35 marbles. After he had paid his playmates, how many did he have left?

**31.** What is the ratio of 6 to 12? 6 to 18? 12 to 18?

**32.** The cost of 12 apples is what part of the cost of 18 apples? What would 12 apples cost if 18 apples cost 30 cents? 15 cents? 21 cents? 24 cents? 9 cents?

**33.** What is the ratio of 6 to 24? Of 12 to 24? Of 18 to 24?

**34.** How much is $\frac{1}{4}$ of 24? $\frac{3}{4}$ of 24? $\frac{1}{2}$ of 24?

**35.** How much will 12 fans cost if 24 fans cost \$.50? \$.60? \$.80?

**36.** How many hours is it from 6 A.M. on Monday till 6 A.M. on Tuesday?

**37.** From 6 A.M. till noon is what part of 24 hours?

**38.** From 6 A.M. till 6 P.M. is what part of 24 hours?

**39.** From 6 A.M. till midnight is what part of 24 hours?

**40.** What is the ratio of 6 to 30? How much is $\frac{2}{5}$ of 30? $\frac{4}{5}$ of 30? $\frac{3}{5}$ of 30?

**41.** What part of the price of 30 apples is the price of 6 apples? 24 apples? 18 apples? 12 apples?

**42.** If 20 cents are paid for 30 apples, how much will 6 apples cost? 12 apples? 24 apples? 18 apples?

**43.** Fill out and learn the following:

$\frac{1}{6}$ of 36 = The ratio of — to 36 is —
$\frac{2}{6}$ or $\frac{1}{3}$ of 36 = The ratio of — to 36 is —
$\frac{3}{6}$ or $\frac{1}{2}$ of 36 = The ratio of — to 36 is —
$\frac{4}{6}$ or $\frac{2}{3}$ of 36 = The ratio of — to 36 is —
$\frac{5}{6}$ of 36 = The ratio of — to 36 is —

**44.** What part of the price of 36 hats is the price of 6 hats? 18 hats? 30 hats? 24 hats? 12 hats?

**45.** How many inches in $\frac{1}{6}$ of a yard? In $\frac{5}{6}$? $\frac{1}{3}$? $\frac{2}{3}$?

**46.** To a line a yard long what is the ratio of a line 6 in. long? Of a line 1 ft. long? Of a line a foot and a half long? Of a line 2 ft. long? Of a line $1\frac{1}{2}$ ft. long?

**47.** Make a table showing 7ths of 42 from $\frac{1}{7}$ to $\frac{8}{7}$.

**48.** Express the ratio to 42 of each of the multiples of 6 less than 50.

**49.** 42 gallons of oil are in a barrel. Tell what fraction of it is gone and what fraction of it is left when 12 gal. have been drawn out. 24 gal. 30 gal. 36 gal.

**50.** If the whole barrel was worth $28, how much would 6 gal. cost? 12 gal.? 24 gal.? 30 gal.? 36 gal.?

**51.** Make a table of the 8ths of 48 up to $\frac{8}{8}$.

**52.** Express the ratio that each of the multiples of 6 less than 61 has to 48.

**53.** How many hours from 12 o'clock noon on Monday to 12 o'clock noon on Wednesday?

**54.** From 12 o'clock till 6 P.M. on Monday is what part of 48 hours?

**55.** From noon till midnight is what part of 48 hours?

**56.** From midnight till 6 P.M. is what part of 48 hours?

**57.** From 6 A.M. Monday to 6 P.M. Tuesday is what part of 48 hours?

**58.** From 6 A.M. Monday till noon on Tuesday is what part of 48 hours? Make a table showing 9ths of 54 up to $\frac{11}{9}$.

**59.** Express the ratio that each of the first 10 multiples of 6 has to 54.

**60.** The price of 6 marbles is what part of the price of 54 marbles? If 54 marbles cost 18 cents, how much will 6 marbles cost? 18? 30? 12? 24? 48? 42? 36?

**61.** 60 seconds make a minute. How many seconds in 2 minutes?

Give the children ideas of minutes by requiring them to keep perfectly still for one minute by the watch, and of seconds by having them beat time, one beat to a second.

**62.** Fill out and learn the table of Time:

—— seconds (sec.) = 1 minute (min.).
—— minutes     = 1 hour (hr.).
—— hours      = 1 day (da.).
—— days       = 1 week (wk.).

**63.** How many sec. in 3 min.? 5 min.? 9 min.? 4 min.? 8 min.? 11 min.? 7 min.? 6 min.? 12 min.

**64.** How many sec. in 8 min. and 2 sec.? 4 min. and 7 sec.? 9 min. and 3 sec.? 8 min. and 10 sec.?

**65.** Make a table showing 10ths of 60 up to $\frac{11}{10}$.

**66.** Make a table showing the ratio to 60 of each of the first 12 multiples of 6.

**67.** What part of a min. is 12 sec.? 30 sec.? 18 sec.? 54 sec.? 42 sec.? 36 sec.? 48 sec.?

**68.** How many min. in 2 hr. and 8 min.? 5 hr. and 9 min.? 6 hr. and 25 min.? 7 hr. and 48 sec.?

**69.** How many minutes in $\frac{1}{2}$ an hour? $\frac{1}{4}$? $\frac{3}{4}$? $\frac{1}{6}$? $\frac{5}{6}$? $\frac{1}{3}$? $\frac{2}{3}$? $\frac{1}{10}$? $\frac{3}{10}$? $\frac{7}{10}$? $\frac{9}{10}$?

**70.** How many minutes in $3\frac{1}{2}$ hr.? $5\frac{1}{3}$ hr.? $7\frac{1}{10}$ hr.? $8\frac{5}{6}$ hr.? $4\frac{9}{10}$ hr.? $6\frac{7}{10}$ hr.? $10\frac{3}{10}$ hr.?

**71.** What part of an hour is 15 minutes? 30? 45? 10? 5? 6? 24? 54? 36? 48? 42? 18?

**72.** Draw a line on the floor 5½ yards long. How many feet long is it? It is 1 rod long. How many feet in 2 rods? 3 rods? 4 rods? 7 rods? 11 rods?

Let rods be measured off in the yard or upon the pavement by means of a string 5½ yards long, and give practical questions in measurement.

**73.** How many feet in the perimeter of an equilateral triangle, each side of which is 1 rod long?

**74.** Make a table showing 11ths of 66 up to $\frac{12}{11}$.

**75.** Express the ratio of each of the first 12 multiples of 6 to 66.

**76.** Robert's house is 66 rods from the schoolhouse. When he has gone 6 rods on his way to school, what part of the distance has he gone, and what part has he yet to go?

**77.** What part of the distance has he gone, and what part has he to go when he has gone 18 rods? 30? 42? 48? 80?

**78.** Draw on the floor a square that is 1 rod long each way. How many feet in its perimeter?

**79.** How many square rods in a garden that is 9 rods long and 6 rods wide? 8 rods long and 7 rods wide?

Let the children mark off on the playground a piece of ground a number of rods long and a number of rods wide, and find the number of square rods.

**80.** 320 rods make a mile. How many rods in 4 miles? 9 miles? 12½ miles?

Call on pupils to mention places that are about a mile distant.

**81.** Fill out and learn the table of Long Measure :

| | |
|---|---|
| —— inches (in.) | = 1 foot (ft.). |
| —— feet | = 1 yard (yd.). |
| —— feet ⎫<br>—— yards ⎭ | = 1 rod (rd.). |
| —— rods | = 1 mile (mi.). |

**82.** John lived a mile south of the post office. His cousin Henry lived $2\frac{1}{2}$ mi. south of it. How many miles must John walk to go to the post office, then on to his cousin's house, and home again? How many rods?

**83.** Make a table showing the 12ths of 72 up to $\frac{12}{12}$.

**84.** Express the ratio of each of the first 12 multiples of 6 to 72.

**85.** A field is 9 rd. long and 8 rd. wide. How many sq. rd. in $\frac{1}{12}$ of it? $\frac{5}{12}$? $\frac{7}{12}$? $\frac{11}{12}$? $\frac{1}{2}$? $\frac{1}{4}$? $\frac{3}{4}$? $\frac{1}{3}$? $\frac{2}{3}$? $\frac{1}{6}$? $\frac{5}{6}$?

**86.** What part of a field 12 rd. long and 6 rd. wide is a lot 2 rd. long and 2 rd. wide? 4 rd. long and 3 rd. wide? 9 rd. long and 2 rd. wide? 8 rd. long and 3 rd. wide? 6 rd. square? 11 rd. long and 6 rd. wide? 12 rd. long and 4 rd. wide? 15 rd. long and 4 rd. wide?

**87.** Draw a diagram of a right triangle whose base is 6 rd. and altitude 3 rd., drawing to a scale of 1 inch to a rod. Find its area.

**88.** What is the ratio of that triangle to a rectangle 6 rd. long and $\frac{1}{2}$ as wide as long? Draw.

**89.** How many inch cubes will be needed to make a square prism 6 in. long, 3 in. wide, and 2 in. high?

**90.** How many cu. ft. in a tank 6 ft. long, 5 ft. wide, and 7 ft. high?

**91.** How many cu. in. of air can there be in a box 6 in. long, 4 in. wide, and 3 in. high?

**92.** If a solid 3 in. long, 2 in. wide, and 2 in. high were placed in the box mentioned in Ex. 91, how many cu. in. of air would be left in it?

**93.** How many cu. ft. of air can there be in a room 60 ft. long, 40 ft. wide, and 12 ft. high?

**94.** If a solid 6 ft. long, 5 ft. wide, and 4 ft. high were placed in the room mentioned in Ex. 93, how many cu. ft. of air would be left in the room?

**95.** Estimate the length, width, and height of the schoolroom, and find about how many cu. ft. of air the room will hold.

Let the children suggest different rectangular solids to be placed in the room, and find the cu. ft. of air displaced by them.

**96.** What is meant by $\frac{1}{6}$ of anything?

**97.** Draw a picture of a pie cut into sixths, and tell how many sixths of a pie in 2 equal pies.    In 4.    7. 8.    5.

**98.** How many sixths in $1\frac{1}{6}$?    In $2\frac{1}{6}$?    In $3\frac{5}{6}$?    In $9\frac{1}{6}$? In $8\frac{5}{6}$?    In $7\frac{1}{6}$?    In $6\frac{5}{6}$?

**99.**    $\frac{13}{6} = ?$    $\frac{19}{6} = ?$    $\frac{47}{6} = ?$    $\frac{25}{6} = ?$    $\frac{35}{6} = ?$    $\frac{43}{6} = ?$
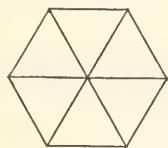


FIG. 1

**100.** Copy Fig. 1 by placing equilteral triangles.   How many sides has the figure? A figure bounded by six straight lines is called a **Hexagon.**

**101.** How long would the perimeter of the hexagon be if each side of a triangle were 6 in. long? 8 in.?   9 in.?   7 in.?

**102.** How many such hexagons could you make from 42 such triangles?   36?   72?   24?   54?   66?

**103.** Divide your hexagon into trapezoids.   What is the ratio of each trapezoid to the hexagon?

**104.** Divide your hexagon into rhombuses.   What is the ratio of each rhombus to the hexagon?

**105.** One of the triangles is what part of the hexagon you have made ? 3 triangles ? 2 triangles ? 4 triangles ? 5 triangles ?

**106.** Divide each triangle that makes your hexagon into 2 right triangles, as in Fig. 2. Hold up one of the right triangles, and show its right angle.



FIG. 2

**107.** Each of your right triangles is what part of an equilateral triangle ? What part of the hexagon ? $\frac{1}{2}$ of $\frac{1}{6} = ?$

**108.** Draw several hexagons of different shapes.

**109.** Form 6 equilateral triangles into a figure that is not a hexagon. Show $\frac{1}{2}$ of $\frac{1}{6}$ of the figure.

**110.** What kind of a fraction is $\frac{1}{2}$ of $\frac{1}{6}$ ? How can the value of that kind of fractions be found ?

**111.** Find value :

| | | | | | |
|---|---|---|---|---|---|
| $\frac{1}{3}$ of $\frac{1}{6}$ | $\frac{1}{3}$ of $\frac{5}{6}$ | $\frac{1}{4}$ of $\frac{1}{6}$ | $\frac{3}{4}$ of $\frac{1}{6}$ | $\frac{1}{5}$ of $\frac{1}{6}$ | $\frac{2}{5}$ of $\frac{1}{6}$ |
| $\frac{3}{5}$ of $\frac{5}{6}$ | $\frac{4}{5}$ of $\frac{5}{6}$ | $\frac{3}{7}$ of $\frac{5}{6}$ | $\frac{3}{6}$ of $\frac{1}{6}$ | $\frac{5}{8}$ of $\frac{1}{6}$ | $\frac{7}{8}$ of $\frac{4}{6}$ |
| $\frac{7}{9}$ of $\frac{1}{6}$ | $\frac{5}{9}$ of $\frac{5}{6}$ | $\frac{8}{9}$ of $\frac{3}{6}$ | $\frac{6}{9}$ of $\frac{4}{6}$ | $\frac{1}{10}$ of $\frac{1}{6}$ | $\frac{3}{10}$ of $\frac{1}{6}$ |
| $\frac{5}{11}$ of $\frac{1}{6}$ | $\frac{5}{11}$ of $\frac{4}{6}$ | $\frac{7}{12}$ of $\frac{1}{6}$ | $\frac{9}{12}$ of $\frac{5}{6}$ | $\frac{8}{12}$ of $\frac{3}{6}$ | $\frac{9}{12}$ of $\frac{4}{6}$ |

**112.** How many rods in 1 mile and 80 rods ?

**113.** George rode on his bicycle 1 mile lacking 10 rods. How many rods did he ride ?

**114.** At 6 cents a pt., what will be the cost of 3 qt. of milk ? Of a gallon ? Of a gallon and a half gallon ?

**115.** At 6 cents a qt., how much will a pk. of beans cost ? A pk. and a half ? A bu.?

**116.** Mary borrowed 60 cents from her brother, and paid him 6 cents of it every week. How many weeks did it take her to pay the whole ?
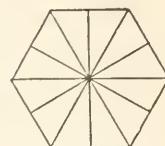
**117.** Paying 6 cents a week, how many weeks would it have taken her to pay 48 cents? 72 cents? 78 cents? 84 cents?

**118.** Sometimes when people borrow money they pay 6 cents for every dollar that they keep for a whole year, besides paying back the dollar. If you lent $3 for a year at that rate, how much would you receive at the end of the year besides the $3 you had lent?

Explain that interest is paid for the use of money just as horse hire is paid for the use of a horse, or rent for the use of a house.

**119.** The money which is paid for the use of money is called **Interest.** If 6 cents are paid for the use of a dollar for one year, how much interest must be paid if it is kept 4 years? 7 years? 9 years? 6 years? 8 years?

**120.** If the interest of a dollar for one year is 6 cents, what is the interest of 3 dollars for a year? Of $5? $7? $9? $12? $6? $8? $4? $11?

**121.** John lent $8 for a year at 6 per cent. (That means 6 cents for every dollar.) How much interest did he get?

**122.** At 6 per cent, what is the interest of $1 for $1\frac{1}{2}$ years? For $2\frac{1}{2}$ years? $4\frac{1}{2}$ years? $6\frac{1}{2}$ years? $8\frac{1}{2}$ years?

**123.** James lent some money at 6 per cent, and received 42 cents interest at the end of a year. How many dollars did he lend? How many dollars must he lend at that rate in order to get 72 cents? 36? 54? 66? 48?

**124.** Arthur has a dollar in a bank that pays 6 per cent. How much interest will it give him in $2\frac{1}{3}$ years? In $4\frac{1}{3}$ years? In $5\frac{1}{3}$ years? In $9\frac{1}{3}$ years?

**125.** What is the interest of a dollar for 7 years at 5 per cent? (5 cents for every dollar.) For 9 years? For 12 years?

**126.** How much will William receive at the end of a year on each dollar that he has in a bank which pays 3 per cent? How much would he receive for $10?

**127.** If a bank paid 5 per cent, how much would May receive at the end of a year if she had $8 in it? How much if she had $5? $7? $4? $10? $9?

**128.** At 6 per cent, how long must I keep a borrowed dollar to pay 24 cents interest? To pay 48 cents? 54 cents? 72 cents? 60 cents?

**129.** Which gives the more interest at the end of a year: $8 loaned at 6 per cent, or $7 at 7 per cent?

**130.** Per cent is sometimes written %. What is the interest of a dollar for 3 years at 6%? For 3 years at 8%?

**131.** Anna may tell how much money she would like to have at interest, and how much it would bring her each year at 6%. At 5%. At 4%.

Let this exercise be general.

**132.** If it costs $286.50 to make 6 wagons, how much will it cost to make 1 wagon? 5 wagons?

**133.** If it costs $47.75 to make one wagon, for how much must the maker sell it to gain $5.25?

**134.** At 6 cents a ft., how much will it cost to fence a lot 1 rd. square? 2 rd. square? 20 rd. square?

Notice that in the following examples one unit of the minuend must be reduced to fractional units.

**135.**

| From | $27\frac{5}{6}$ | 38 | 47 | 56 | 28 | 96 |
|------|-----------------|----|----|----|----|----|
| take | $17\frac{1}{6}$ | $2\frac{1}{2}$ | $3\frac{1}{3}$ | $4\frac{2}{3}$ | $4\frac{1}{6}$ | $3\frac{5}{6}$ |

**136.** Write in Roman notation two factors of 77.

# CHAPTER XV

## TWELVES

### Long Division, Square Foot, Cubic Foot, Common Multiple

#### NUMBER TABLE

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 11 | 21 | 31 | 41 | 51 | 61 | 71 | 81 | 91 |
| 2 | **12** | 22 | 32 | 42 | 52 | 62 | **72** | 82 | 92 |
| 3 | 13 | 23 | 33 | 43 | 53 | 63 | 73 | 83 | 93 |
| 4 | 14 | **24** | 34 | 44 | 54 | 64 | 74 | **84** | 94 |
| 5 | 15 | 25 | 35 | 45 | 55 | 65 | 75 | 85 | 95 |
| 6 | 16 | 26 | **36** | 46 | 56 | 66 | 76 | 86 | **96** |
| 7 | 17 | 27 | 37 | 47 | 57 | 67 | 77 | 87 | 97 |
| 8 | 18 | 28 | 38 | **48** | 58 | 68 | 78 | 88 | 98 |
| 9 | 19 | 29 | 39 | 49 | 59 | 69 | 79 | 89 | 99 |
| 10 | 20 | 30 | 40 | 50 | **60** | 70 | 80 | 90 | 100 |

**1.** Count by twelves to 96. How many twelves did you count?

**2.** Count by twelves from 96 to 144. How many twelves from 96 to 144?

**3.** Count backwards by twelves from 144 to 0.

**4.** Write and learn the table of twelves up to 144.

**5.** How many twelves in 48 ? 72 ? 36 ? 96 ? 60 ?

**6.** Name the 7th multiple of 12 ; the 5th ; 9th ; 6th.

**7.** Add 2 twelves to 24, 60, 36, 84, 12, 48, 72, 108, 96.

**8.** Take 2 twelves from 96, 60, 144, 108, 48, 84, 36, 72.

**9.** How many twelves must be added to 24 to make 60 ? 36 ? 72 ? 48 ? 96 ?

**10.** How many twelves must be subtracted from 96 to leave 72 ? 48 ? 24 ? 84 ? 36 ? 60 ?

**11.** How many twelves must be added to 36 to equal 6 twelves ? 5 twelves ? 9 twelves ? 7 twelves ? 12 twelves ?

**12.** How many twelves must be taken from 108 to leave 7 twelves ? 4 twelves ? 6 twelves ? 3 twelves ? 5 twelves ?

**13.** 3 twelves+5=? 7 twelves+9=? 9 twelves+10=?

**14.** 9 twelves−4=? 7 twelves−6=? 4 twelves−9=?

**15.** How many sixes in 2 twelves ? 3 twelves ? 5 twelves ? 8 twelves ? 6 twelves ?

**16.** How many threes in 12 ? In 2 twelves ? 3 twelves ? 4 twelves ? 6 twelves ? 5 twelves ?

**17.** How many fours in 12 ? In 2 twelves ? 3 twelves ? 4 twelves ? 5 twelves ? 7 twelves ?

**18.** How many twelves in 4 sixes ? In 10 sixes ? 8 sixes ?

**19.** How many twelves in 3 eights ? In 6 tens ? 12 sixes ?

**20.** 12 is $\frac{1}{2}$ of what number ? $\frac{1}{5}$ of what ? $\frac{1}{8}$ of what ? $\frac{1}{6}$ of what ? $\frac{1}{12}$ of what ? $\frac{1}{7}$ of what ? $\frac{1}{4}$ of what ?

**21.** Make a list of the multiples of 12 that are less than 145 and of the factors that compose them, as:

$$12 = 2 \times 6 \text{ or } 3 \times 4$$
$$24 = 2 \times 12 \text{ or } 3 \times 8 \text{ or } 4 \times 6.$$

**22.** There are four numbers besides 12 that are contained in every multiple of 12. Name them.

**23.** Add the number whose factors are 8 and 7 to the number whose factors are 8 and 9. How many eights does their sum contain?

**24.** Find the difference between the number that is composed of 8 and 6 and the number composed of 4 and 12.

**25.** What is the ratio of the number whose factors are 3 and 7 to the number whose factors are 5 and 7?

**26.** How many hours does it take the hour hand of a clock or watch to go once around the face? How many hours to go one half the way around? $\frac{1}{4}$ of the way? $\frac{3}{4}$ of the way? $\frac{1}{3}$ of the way? $\frac{2}{3}$ of the way?

**27.** How many hours does it take for the hour hand to go around twice? 3 times? 5 times? 6 times?

**28.** In 24 hours, how many times does the hour hand go around the face of a clock? In 60 hr.? 72 hr.? 96 hr.?

**29.** How many times does the minute hand of a clock go around the face between noon and midnight? How many times between noon to-day and noon to-morrow? Between noon on Monday and noon on Wednesday?

**30.** Name the months of the year in order, beginning with January.

**31.** How many months in 2 years? In 4 years? In 8 years? In 10 years? In 12 years? In $\frac{1}{2}$ of a year?

**32.** How many years in 25 months? 39 months? 50 months? 67 months? 109 months? 88 months?

**33.** If you save a dollar a month for 3 years, how much money will you save?

**34.** How much money will you save if you lay aside one dollar a month for $2\frac{1}{2}$ years? For 5 years? $3\frac{1}{2}$ years?

**35.** How many months had you lived when you were just 6 years old?

**36.** Margaret was 9 years old on the 1st day of last month. How many months has she lived and how many days over?

Let each child in the class reckon up the number of whole months he has lived and the days over.

**37.** How many eggs in 7 dozen? 12 dozen? $3\frac{1}{2}$ dozen? $8\frac{1}{2}$ dozen? $2\frac{1}{3}$ dozen? $6\frac{2}{3}$ dozen?

**38.** How many dozen eggs in 48 eggs? 72 eggs?

**39.** Gertrude is visiting her cousin Alice. She has spent 12 days at Alice's house and $\frac{1}{3}$ of her visit is gone. How long was the visit to be and how many days longer can she stay?

**40.** How many in. long is a line that is 2 ft. long? $2\frac{1}{2}$ ft.? $3\frac{1}{2}$ ft.? $4\frac{1}{2}$ ft.? 6 ft.? $7\frac{1}{2}$ ft.? $8\frac{1}{3}$ ft.? 9 ft.?

**41.** How many ft. long is a line that is 36 in.? 60 in.? 84 in.? 108 in.?

**42.** Draw on the board a square 1 foot each way, and divide it off into square inches. How many rows of squares? How many squares in each row? How many squares in all?

**43.** How many sq. in. in 2 sq. ft.? 3 sq. ft.? 5 sq. ft.?

**44.** How many sq. in. in a square which is 2 ft. long?

**45.** How many sq. in. in a sq. yd.?

The square foot with its subdivisions of square inches should remain on the board where the children can see it for several days, and occasional short drills should be given by questions similar to those relating to dozens.

**46.** What is the ratio of 12 to 24? 12 to 36?

Use chart drill.

**47.** How many inches in $\frac{1}{3}$ of a yd.? In $\frac{2}{3}$ of a yd.?

**48.** What is the ratio of 12 to 48? What is $\frac{2}{4}$ or $\frac{1}{2}$ of 48? $\frac{3}{4}$ of 48?

**49.** A lot has a frontage of 12 rods and a depth of 48 rods. What is the ratio of the length of the front fence to the side fence? How many rods of fencing will it take to inclose it? How much will the fence cost at $.15 a ft.?

**50.** What is the ratio of 12 to 60? What number is $\frac{2}{5}$ of 60? $\frac{4}{5}$ of 60? $\frac{3}{5}$ of 60?

**51.** A's house is 60 rd. from B's house. When A has gone $\frac{2}{5}$ of the way to B's house, how many rd. is he from his own house? How far is he from B's house? How far is he from each house when he has gone $\frac{4}{5}$ of the way to B's house?

**52.** Susan has to practice on the piano an hour every morning. How many fifths of her practice hour are past when she has practiced 24 minutes? 48 minutes?

**53.** Fill out and learn :

$\frac{1}{6}$ of 72 =         The ratio of — to 72 is —
$\frac{2}{6}$ or $\frac{1}{3}$ of 72 =      The ratio of — to 72 is —
$\frac{3}{6}$ or $\frac{1}{2}$ of 72 =      The ratio of — to 72 is —
$\frac{4}{6}$ or $\frac{2}{3}$ of 72 =      The ratio of — to 72 is —
$\frac{5}{6}$ of 72 =         The ratio of — to 72 is —

**54.** A farmer buys a wagon for $72 and pays $12 cash. What fractional part of the price does he pay, and what part does he still owe?

**55.** At the end of six months he pays $24 more. What part of the price does he still owe?

**56.** He pays $24 at the end of another six months. What part of the price does he still owe?

**57.** Draw a rectangle 1 ft. long and 6 in. wide. Divide it into 6ths. How many sq. in. in each sixth? How many in $\frac{5}{6}$ of it? In $\frac{2}{6}$ or $\frac{1}{3}$ of it? In $\frac{4}{6}$ or $\frac{2}{3}$ of it?

**58.** Make a table showing sevenths of 84 from $\frac{1}{7}$ to $\frac{8}{7}$.

**59.** Make a table showing the ratio to 84 of each multiple of 12 less than 100.

**60.** A fence 84 ft. long costs $21. 12 ft. of the fence cost what part of the money? How many dollars? How many dollars do 36 ft. cost? 60 ft.? 72 ft.? 24 ft.?

**61.** Make a table of the 8ths of 96 as far as $\frac{8}{8}$.

**62.** Make a table showing the ratio of each of the first 8 multiples of 12 to 96.

**63.** If an acre of land costs $96, how much do $\frac{3}{8}$ of an acre cost? $\frac{5}{8}$? $\frac{9}{8}$? $\frac{1}{4}$? $\frac{1}{2}$? $\frac{3}{4}$?

**64.** 160 square rods make an acre. Into how many pieces of ground 2 rods square can an acre be divided?

Let children get ideas of an acre by measuring off distances on the playground, estimating the length of a line about 290 feet long and the area of a square of these dimensions.

**65.** A farmer has a farm of 96 acres. 12 acres are planted with potatoes, 24 with corn, 36 with wheat, and the rest is pasture land. What part of the farm is planted with potatoes? Corn? Wheat? What part is pasture land?

**66.** Make problems about 8ths of 96.

**67.** Make a table showing 9ths of 108 from $\frac{1}{9}$ to $\frac{9}{9}$. Make a table showing the ratio of each of the first 9 multiples of 12 to 108.

**68.** The cost of 12 pencils will be what part of the cost of 108 pencils? Supposing that 108 pencils cost 45 cents, how much would 12 pencils cost?

Let children suppose different prices for different numbers of pencils.

**69.** What part of the cost of 108 pencils is the cost of 24 pencils? Of 36 pencils? 60 pencils? 72 pencils?

**70.** If 1 dozen pencils cost 5 cents, how many times as much will 108 pencils cost ? How many cents would that be ?

**71.** Make problems about 9ths of 108.

**72.** Make a table of the 10ths of 120 up to $\frac{10}{10}$.

**73.** Make a table showing the ratio to 120 of each of the multiples of 12 that are less than 120.

**74.** John had $1.20 and spent 12 cents. What part of his money did he spend ? What part had he left ?

**75.** What part had he spent and what part was left when he had spent 24 cents ? 48 cents ? $.60 ? $.72 ?

**76.** Make a table showing $\frac{1}{11}$ to $\frac{11}{11}$ of 132.

**77.** Make a table showing the ratio to 132 of each of the multiples of 12 less than 132.

**78.** How long is a line that is $\frac{2}{11}$ as long as a line 132 inches long ? $\frac{7}{11}$ as long ? $\frac{3}{11}$ as long ? $\frac{9}{11}$ ? $\frac{5}{11}$ ? $\frac{10}{11}$ ? $\frac{6}{11}$ ? $\frac{12}{11}$ ? $\frac{4}{11}$ ? $\frac{8}{11}$ ? $\frac{11}{11}$ ?

**79.** A certain house is 132 miles from Philadelphia. What fraction of that distance has a man traveled who has gone 12 miles toward Philadelphia ? What part of the distance does he still have to travel ?

**80.** When he has traveled 24 mi., what part of the distance has he traveled and what part remains ? What part has he gone over, and what part remains, when he has traveled 48 mi. ? 60 mi. ? 84 mi. ? 96 mi. ? 120 mi. ?

**81.** Make a table showing 12ths of 144 from $\frac{1}{12}$ to $\frac{12}{12}$.

**82.** Make a table showing the ratio of each of the first 12 multiples of 12 to the number 144.

**83.** A jar of butter is priced at $1.44. How much will $\frac{1}{12}$ of it cost ? $\frac{3}{12}$ or $\frac{1}{4}$ of it ? $\frac{5}{12}$ ? $\frac{7}{12}$ ? $\frac{6}{12}$ ? $\frac{9}{12}$ ? $\frac{11}{12}$ ?

**84.** What part of a square foot is 48 square inches ? 24 sq. in. ? 60 sq. in. ? 96 sq. in. ? 120 sq. in. ?

**85.** How many inches of ribbon will it take to bind a lamp mat that is one foot square ?

**86.** What is the square of 12 ?

**87.** $\frac{1}{5}$ of Harry's money is 12 cents. How much has he ? How many cents had he when $\frac{1}{5}$ of his money was 9 cents ? 7 cents ? 11 cents ? 13 cents ?

**88.** Louisa has 12 cents. John has 3 times as many cents and 5 cents more. How many cents has John ?

**89.** If Mary had 3 cents more, she would have twice as much as Jennie, who has 12 cents. How many cents has Mary ?

**90.** Divide 276 by 12 by long division.

SOLUTION

$$12)\overline{276}(23$$
$$\underline{24}$$
$$\overline{36}$$
$$\underline{36}$$

Show the process and let the children become expert in it before giving an explanation of it.

**91.** By long division find the quotient of 288 and 12.

**92.** By 12 divide 1728, 3456, 432, 264, 384, 636.

**93.** Divide 373 by 12 and see if you get the answer $31\frac{1}{12}$.

**94.** Divide by 12 each of the numbers between 500 and 600 whose unit figure is 6.

**95.** Divide by 11 each of the numbers between 600 and 700 whose unit figure is 5.

**96.** How many feet in 189 inches ? 474 in.? 699 in.?

**97.** How many dozen eggs in 972 eggs ? 852 eggs ?

**98.** John was given $2.64 with which to buy coffee. How many lb. could he buy at 12 cents a lb.? At 11 cents a lb.?

**99.** How many years in 898 months? 961 months? 6846 months? 7849 months?

**100.** At his last birthday Mr. Smith had lived 336 months. How many years old was he?

**101.** How many years old will you be when you have lived 216 months? 348 months? 396 months? 456 months?

**102.** A dozen readers cost $4.20. What is the price of each?

**103.** How much rent does Mr. Jones pay each month when his yearly rent is $288? How much when his yearly rent is $384?

**104.** William has $2.00 at interest at 6%. How much does it gain each year? In how many years will it gain $1.56? $2.16? $3.72?
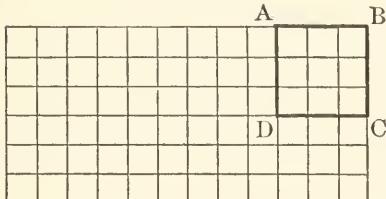


Fig. 1

**105.** Fig. 1 represents a floor 12 ft. long and 6 feet wide. How many square ft. are represented by *ABCD*? How many square yd. will it take to cover the floor? Draw the figure and outline the square yd.

**106.** Draw a figure to represent a square floor 12 ft. long, and show how many square yd. of linoleum it will take to cover it by outlining with a heavy line each figure that represents a square yard.

**107.** Arrange equilateral triangles as in Fig. 2. Show $\frac{1}{2}$ of the figure and tell how many 12ths it equals.

**108.** Separate the figure into 4 trapezoids. $\frac{1}{4}$ = how many 12ths? $\frac{3}{4}$ = how many 12ths?

**109.** Separate the figure into 6 rhombuses. $\frac{1}{6}$ = how many 12ths? $\frac{5}{6}$ = how many 12ths?

FIG. 2

**110.** How long is the perimeter of Fig. 2, if each side of the triangles is 12 in. long? 9 in.? 8 in.?

**111.** If the perimeter of Fig. 2 is 70 inches, how long is each side of the triangles?

**112.** How many triangles in this six-pointed star? How many triangles would it take to make 9 such stars? 6 such stars? 11 such stars?

**113.** Copy Fig. 3 by placing equilateral triangles. Separate your copy into 6 equal rhombuses. Each rhombus is what fractional part of the figure? Each triangle is what fractional part of a rhombus? $\frac{1}{2}$ of $\frac{1}{6}$ = ?

FIG. 3

**114.** Remove triangles from the figure until you have a hexagon left. What fractional part of the figure did you take away?

**115.** Copy Fig. 4 by placing equilateral triangles. Separate your figure into 4 equal trapezoids. Each trapezoid is what part of the whole figure? Each triangle is what part of a trapezoid? $\frac{1}{3}$ of $\frac{1}{4}$ = ?

FIG. 4

**116.** If the perimeter of Fig. 4 were 396 inches, how long would each side of the triangles be?
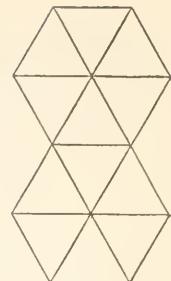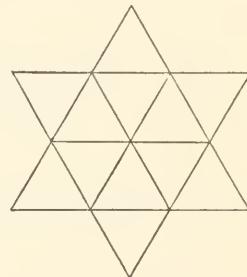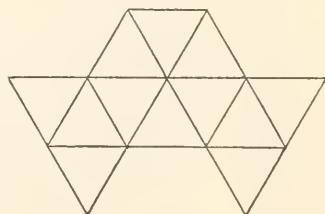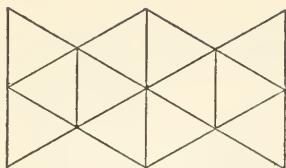
FIG. 5

**117.** Can you make Fig. 5 by changing the place of one of the trapezoids in Fig. 4?

**118.** Show by Fig. 5 that $\frac{1}{12}$ is equal to $\frac{1}{3}$ of $\frac{1}{4}$.

**119.** How long would each side of the triangles be if the perimeter of the figure were 72 in.? 396 in.? 528 in.?

**120.** How many inch-cubes would it take to make a layer of them 12 in. long and 12 in. wide?

**121.** How many inch-cubes would it take to make 2 such layers? 8 layers? 9 layers? 11 layers? 12 layers?

**122.** A cubic foot is 12 inches long, 12 inches wide, and 12 inches high. How many cubic inches make a cubic foot?

Let children show their ideas of the dimensions of a cubic foot by outlining with their hands.

**123.** Find how many cu. in. make 2 cu. ft. 3 cu. ft. 5 cu. ft. 7 cu. ft. 9 cu. ft. 11 cu. ft.

**124.** How many cubic inches in $\frac{1}{2}$ of a cubic foot? $2\frac{1}{2}$ cu. ft.? $3\frac{1}{2}$ cu. ft.? $4\frac{1}{2}$ cu. ft.? $6\frac{1}{2}$ cu. ft.?

**125.** A line 1 in. long is what fractional part of a line 1 ft. long? Half an inch is what part of a foot? $\frac{1}{2}$ of $\frac{1}{12}$ = ?

**126.** What kind of a fraction is $\frac{1}{2}$ of $\frac{1}{12}$? How do you find the value of it?

**127.** $\frac{1}{3}$ of $\frac{1}{12}$ = ?   $\frac{2}{3}$ of $\frac{7}{12}$ = ?   $\frac{4}{5}$ of $\frac{11}{12}$ = ?   $\frac{6}{7}$ of $\frac{5}{12}$ = ?

**128.** A square inch is what part of a square foot?

**129.** $\frac{84}{12}$ = ?   $\frac{48}{12}$ = ?   $\frac{96}{12}$ = ?   $\frac{128}{12}$ = ?   $\frac{25}{12}$ = ?   $\frac{38}{12}$ = ?
$\frac{49}{12}$ = ?   $\frac{65}{12}$ = ?   $\frac{78}{12}$ = ?   $\frac{86}{12}$ = ?   $\frac{99}{12}$ = ?   $\frac{110}{12}$ = ?   $\frac{145}{12}$ = ?

**130.** At 12 cents a yd., how much ribbon can be bought for 29 cents? $.31? $.89? $1.29? $2.89? $1.58?

**131.** Name the unit figure of each of the multiples of 12 given in their order up to 144. Can any of these multiples of 12 be odd numbers?

**132.** Which multiple of 12 is 36? How many times does 36 contain 12?

**133.** Think of a number and of one of its multiples, and see if this definition is true. " A multiple of a number is a number that will contain it without a remainder."

**134.** There is one multiple of 12 less than 100 that is also a multiple of 5. What is it?

**135.** What number less than 100 is a multiple of 12 and also of 7?

**136.** When a number is a multiple of two other numbers, it is called a **Common Multiple** of them. Name a common multiple of 5 and 12, 8 and 7, 11 and 5.

**137.** 42 is a common multiple of 6 and what other number?

**138.** Turn to the number table of 9's, and see how many of the multiples of 9 in it are also multiples of 12. Make a list of these common multiples of 9 and 12. Which is the least?

**139.** Make a list of the multiples of 12 and of 8 that you have learned. Show those that are common multiples of 12 and 8. Which is the least common multiple?

**140.** Turn to the number table of 6's, and the number table of 8's, and you will see that the multiples of 6 meet the multiples of 8 in the numbers 24, 48, 72, 96. What is the least number that contains both 8 and 6?

A way of showing this meeting of the multiples is to have the pupils put the first hundred numbers on the board, writing all the multiples of one number with crayon of a certain color and those of other numbers with other colors. For instance, if the multiples of 6

are red, 8 blue, and 9 yellow, 72 will show itself in its varicolored representation as a multiple of them all.

**141.** Make a list of the common multiples of 6 and 9 that are less than 100, and tell which is the least common multiple.

**142.** What is the least common multiple of 6 and 7? 6 and 11? 6 and 5?

**143.** Find the least common multiple of 6 and 8 without looking at the number tables.

Show the following method: To find the least common multiple of two numbers, take the largest of the numbers and name its multiples in order until one is found that is also a multiple of the other number. Thus, to find the least common multiple of 6 and 8, name the multiples of 8 in order, 8, 16, 24, trying each one to see if it will contain 6, until one is found that will contain it.

**144.** Find the first number in which the multiples of 8 meet the multiples of 3. In what number do the multiples of 8 first meet the multiples of 5? 7? 10?

**145.** Find the least common multiple of 12 and 9, 12 and 8, 12 and 10, 12 and 7.

**146.** Find the least common multiple of 9 and 6, 9 and 4, 9 and 5, 9 and 8, 8 and 10, 10 and 6.

**147.** Mary may name two numbers less than 13, and the class may find the least common multiple of them.

Let this exercise be general.

**148.** 6 is a common multiple of what two other numbers?

**149.** Of what two numbers is 35 the least common multiple? 21? 77? 15?

**150.** Write in Roman notation the least common multiple of 12 and 7.

# CHAPTER XVI

## REVIEW

AVERAGE, COMMON DIVISOR, ADDING, SUBTRACTING, AND
MULTIPLYING DENOMINATE NUMBERS, PER CENT, BILLS

**1.** Find by long division the quotient of 748 and 11.
Of 799 and 12.

**2.** Fill out this table of the products of 21 multiplied
by numbers from 2 to 9.

APPLICATION

$21 \times 2 = 42$         21)1491(71

$21 \times 3 = 63$          147

$21 \times 4 =$              21

                             21

**3.** Divide 2541 by 21.

Tables of products are very helpful to pupils in beginning long
division, but they should be encouraged to dispense with them as soon
as possible, and to estimate their trial quotients carefully.

**4.** Find how many times 21 is contained in each of the
following numbers : 2352, 2583, 2982, 3003, 2835.

**5.** By 31 divide : 3503, 3787, 3875, 4154, 3906, 4092.

**6.** By 22 divide : 2706, 2662, 2816, 2984, 2882, 2728.

**7.** How many times is 32 contained in 3872 ?   4224 ?

**8.** By 41 divide : 5125, 5882, 4961, 5371, 5494, 5412.

**9.** Use 42 as a divisor of : 5337, 5166, 5418, 5124, 5712.

**10.** How many times is 25 contained in 1775 ?   8126 ?

**11.** How many times does 879 contain 22 ?   32 ?   62 ?

**12.** How many times does the square of 21 contain 49 ?

**13.** If 31 men own in equal shares a mine which pays $18,775 this year, what is each man's share of the profits?

**14.** How much is $\frac{1}{32}$ of 6824?   8965?   4869?   12428?

**15.** If 16 lb. of beef cost $2.56, how much does 1 lb. cost?

**16.** At $.33 a gallon, how many gallons of vinegar can be bought for $4.62?   $4.95?   $7.92?   $8.91?   $8.25?

**17.** Think of a number that is as much greater than 10 as it is less than 14.

**18.** Find a number that is as much less than 20 as it is greater than 12.

**19.** What number is halfway between 10 and 20?   24 and 30?   40 and 50?   25 and 45?

**20.** A number that is halfway between two numbers is called the average of those numbers.   What is the average of 16 and 20?   18 and 22?

**21.** How long is a line whose length is the average of an 8-inch line and a 10-inch line?

**22.** To find the average of two numbers, divide their sum by 2.   Find the averages in the last five examples in that way.

**23.** Julia is 12 years old and Jennie is 16 years old. What is the average of their ages?

**24.** What is the average of 146 and 178?   234 and 478?

**25.** Sometimes the average of numbers is a fractional number.   Find the average of 7 and 8, 17 and 20, 46 and 53, 18 and 47.

**26.** Find the average of 19 and 49, and tell how much greater the average is than 19, and how much less than 49.

**27.** The average of 27 and 55 is how much more than 27?   How much less than 55?

**28.** To find the average of 3 numbers, divide their sum by 3. Find the average of 20, 22, and 24. 33, 36, and 39.

**29.** To find the average of 4 numbers, divide their sum by 4. Find the average of 21, 48, 72, and 95.

**30.** Alfred's % in an arithmetic test was 95, in geography 94, in spelling 90, and in writing 93. What was his average %?

**31.** What was the average age of the children of a family of which the youngest was 8 years old, the next 12, the next 15, and the oldest 17?

Show that in finding the average of numbers, their sum is divided by the number of them. Make class exercises by averaging the ages of different groups, or their standing in tests.

**32.** In 5 days Fanny worked 75 problems. How many did she average a day?

**33.** The Blount Plow Works made 12,345 plow points in June, 12,675 in July, and 12,945 in August. What was the average made in the summer months?

**34.** If twice as many plow points were made in December as in June, 5555 more in January than in July, and 3345 more in February than in August, how many plow points were made in the winter? What was the average number of plow points made in the winter months?

**35.** Harold earns $10.25 per week, Fred earns $11.50 per week, and Ernest earns $12.75 per week. How much are the average wages of the boys?

**36.** 14 companies of soldiers have 1372 men enrolled. What is the average number in a company?

**37.** A school of 43 pupils was found to weigh 3483 pounds. What was the average weight of the pupils?

**38.** The combined height of the pupils of the same school was 172 feet. What was the average height?

**39.** Use 71 as a divisor and as dividends, 994, 6045, 3903.

**40.** With 2982 as a dividend use as divisors, 71, 15, 28.

**41.** What is the quotient when 884 is the dividend and 52 the divisor?

**42.** What is the quotient when 1632 is the dividend and 51 the divisor? Multiply the quotient by 51 and compare it with 1632.

**43.** What is the quotient when 2542 is the dividend and 62 the divisor? Multiply the quotient by the divisor and compare it with the dividend.

**44.** Find quotient when 3888 is the dividend and 81 the divisor. Compare the product of divisor and quotient with dividend.

Give examples similar to the above until it is seen that when there is no remainder the dividend is equal to the product of the divisor and quotient. Then require examples proved.

**45.** $2208 \div 92 = ?$    $1952 \div 122 = ?$    $3025 \div 121 = ?$
$8734 \div 312 = ?$    $4551 \div 123 = ?$    $8988 \div 214 = ?$

**46.** $\frac{6104}{132} = ?$   $\frac{7896}{141} = ?$   $\frac{14008}{412} = ?$   $\frac{10922}{242} = ?$   $\frac{3013}{131} = ?$

**47.** Find quotient when 697 is the dividend and 21 is the divisor. Multiply your quotient by 21, add the remainder 4, and see what number the result equals.

By oral work with small numbers lead the class to see the method of proof in this case.

Find quotient and remainder, and prove:

| | DIVIDEND. | DIVISOR. | | DIVIDEND. | DIVISOR. |
|---|---|---|---|---|---|
| **48.** | 3839 | 142 | **53.** | 4839 | 156 |
| **49.** | 15699 | 215 | **54.** | 17898 | 213 |
| **50.** | 4294 | 126 | **55.** | 5307 | 221 |
| **51.** | 5782 | 134 | **56.** | 5808 | 215 |
| **52.** | 4879 | 212 | **57.** | 15413 | 214 |

**58.** When 2 oranges can be bought for 5 cents, how much will 1 orange cost? 3? 7? 11? 12? 20? 40?

**59.** How many cubic inches in a two-inch cube? Draw a picture of it. How many square inches in all its surfaces?



FIG. 1

**60.** How many lb. in a ton? In $2\frac{1}{2}$ tons? $7\frac{1}{4}$ tons?
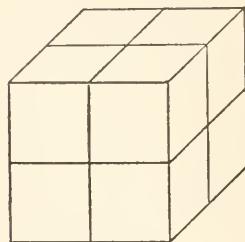
**61.** A farmer sold $5\frac{1}{4}$ tons of hay at $10 a ton. How much did he receive? He bought a wagon for $48.25. How much did he have left?

**62.** Find sums:

$$\begin{array}{ccc} 9\frac{1}{2} & 8\frac{1}{3} & 8\frac{1}{4} \\ 5\frac{1}{2} & 7\frac{2}{3} & 1\frac{3}{4} \\ 6\frac{1}{2} & 6\frac{1}{3} & 9\frac{1}{4} \end{array}$$

**63.** Find differences:

$$\begin{array}{cccc} 5\frac{3}{4} & 38\frac{1}{2} \text{ or } \frac{2}{4} & 76\frac{1}{2} & 81\frac{1}{2} \\ 2\frac{1}{4} & 29\frac{1}{4} & 38\frac{1}{4} & 29\frac{1}{4} \end{array}$$

**64.** From   8      2      6      5      6      7      8
       take   $6\frac{1}{2}$   $0\frac{1}{2}$   $4\frac{1}{2}$   $4\frac{1}{3}$   $3\frac{1}{3}$   $5\frac{1}{4}$   $1\frac{1}{4}$

**65.** Multiply :   $3\frac{1}{3}$   $6\frac{2}{3}$   $1\frac{2}{3}$   $21\frac{1}{4}$   $9\frac{1}{4}$   $96\frac{1}{4}$
                7      4      7      8      11      12

**66.** 1 ft. is what part of a yd.? 1 in. is what part of a ft.? $\frac{1}{12}$ of $\frac{1}{3}$ of a yd. is what part of a yd.?

**67.** How many feet does a man walk who walks three times around a lot 4 rods square? Draw diagram.

**68.** A night watchman has the duty of walking four times each night around a lot that is 18 rd. long and 15 rd. wide. How many ft. does he walk?

**69.** Draw a picture of a 3-inch cube. How many cu. in. in a 3-inch cube? How many sq. in. in all its faces?

**70.** What is the ratio of 6 to 3, or how many times does 6 contain 3?

**71.** Draw a line 3 inches long and divide it into inch lines. Each inch line has what ratio to the 3-inch line? A line 2 inches long has what ratio to the 3-inch line? A line 4 inches long has what ratio to the 3-inch line? A line 6 inches long has what ratio to the 3-inch line? What does $\frac{6}{3}$ equal?

By illustration with lines of different lengths lead children to see that the ratio of a larger number to a smaller one is the quotient of the larger divided by the smaller. Later they may be shown that every ratio is a quotient.

**72.** What is the ratio of 12 to 3? 21 to 3? 25 to 3?

**73.** 6 apples will cost how many times as much as 3 apples? If 3 apples cost 2 cents, how much will 6 apples cost? 9 apples? 15 apples?

**74.** When corn is $.42 a bushel, how many bushels can be bought for $7.56? $13.02? $14.70? $10.08?

**75.** How many cubic inches in a 4-inch cube? Draw a picture of one and tell how many sq. in. in its surfaces.

**76.** How many 2-inch cubes can a 4-inch cube be divided into?

**77.** What is the ratio of 20 to 4? 36 to 4? 48 to 4?

**78.** What is the ratio of 576 to 12? 1728 to 12? 996 to 12?

**79.** 8 apples will cost how many times as much as 4 apples sold at the same rate? If 4 apples cost 5 cents, how much will 8 apples cost? 12 apples? 16 apples?

**80.** 5 is one of a pair of factors that make 55. What is the other factor? Find the factor that helps 12 to make 516.

**81.** How many yd. in 6 rd.? 8 rd.? 3 rd.? 11 rd.?

**82.** How many nickels equal 35 cents? $.75? $.95?

**83.** Name four numbers of which 5 is a factor.

**84.** When a number is a factor of two or more numbers, it is called a **Common Divisor** of them. Name a common divisor of 6 and 9, 12 and 8, 15 and 20, 25 and 35, 21 and 35, 18 and 20, 18 and 27, 14 and 21, 15 and 20.

**85.** Turn to the number table of sevens and tell what number is a common divisor of all the multiples of 7 that are in the table.

**86.** Name two numbers that have a common divisor, and tell what it is.

**87.** Name three numbers that have a common divisor, and tell what it is.

**88.** Turn to a number table and look at the numbers whose unit figure is 5. What number is a common divisor of them all?

**89.** Give a number that is a common divisor of all the numbers whose unit figure is 0.

**90.** What number is a common divisor of all the even numbers?

**91.** Name a common divisor of all the numbers that are printed in heavy type in the number table on p. 114. On p. 122. On p. 142. On p. 180.

**92.** Write out all the pairs of factors that make 20, and all those that make 45, and tell which is the greatest divisor that is common to 20 and 45.

**93.** Find three common divisors of 12 and 18. Which is the greatest ?

**94.** Find two common divisors of 12 and 20, and tell which is the greatest.

**95.** Make a list of common divisors of 20 and 40, and tell which is their greatest common divisor.

**96.** Make a list of the divisors, and pick out the greatest common divisor of 20 and 30, 15 and 24, 30 and 40, 24 and 30, 24 and 36, 25 and 30, 36 and 40, 35 and 49.

**97.** What is the ratio of 30 to 5 ? 40 to 5 ? 45 to 5 ?

**98.** 10 hats will cost how many times as much as 5 hats ? 20 hats will cost how many times as much as 5 hats ? If 5 hats cost \$3, how much will 10 hats cost ? 20 hats ? 30 hats ? 35 hats ?

**99.** How many cubic inches in a 5-inch cube ? How many square inches in its faces ?

**100.** Add : $1\frac{3}{5}$  $6\frac{1}{5}$  $1\frac{4}{5}$   **101.** From $61\frac{3}{5}$  $94\frac{3}{5}$  27  16
$7\frac{1}{5}$  $2\frac{4}{5}$  $8\frac{3}{5}$    take $38\frac{1}{5}$  $37\frac{2}{5}$  $3\frac{1}{5}$  $2\frac{3}{5}$

**102.** A bolt of cloth contained $37\frac{3}{5}$ yd. When $12\frac{1}{5}$ yd. were sold, how many yards remained ?

**103.** Multiply  $75\frac{1}{5}$  $85\frac{3}{5}$  $28\frac{4}{5}$  $27\frac{1}{5}$  $4\frac{3}{5}$  $6\frac{2}{5}$
by  7  9  15  6  7  5

**104.** If \$1285.75 is divided among 5 men, how many dollars and cents will each man receive ?

**105.** How many sixths of a pie in 2 pies and $\frac{1}{6}$ of a pie ? In $3\frac{1}{6}$ pies ? $5\frac{1}{6}$ ? $7\frac{5}{6}$ ? $8\frac{1}{6}$ ? $10\frac{5}{6}$ ? $9\frac{1}{6}$ ? $20\frac{1}{6}$ ? $30\frac{5}{6}$ ?

**106.** From  17  18  24   **107.** Multiply $6\frac{1}{6}$  $8\frac{1}{6}$  $8\frac{5}{6}$
take  $2\frac{1}{6}$  $4\frac{1}{6}$  $3\frac{5}{6}$    by  5  6  7

**108.** Find $\frac{1}{6}$ of \$248.66. Of \$366.72. Of \$968.22 Of \$1575.36.

**109.** At 6%, what is the interest of a dollar for 6 months, or $\frac{1}{2}$ a year? 1 year and 6 months? 2 years and 6 months?

**110.** How many seconds in $\frac{1}{2}$ a minute? In $\frac{1}{3}$? In $\frac{2}{3}$? How many minutes in one quarter of an hour? In $\frac{3}{4}$ of an hour? In $\frac{1}{6}$ of an hour?

**111.** How many cu. in. in a 6-inch cube? Into how many 3-inch cubes can a 6-inch cube be divided?

**112.** How many square inches of paper would it take to cover a box in the shape of a cube, each side of which is 6 inches?

**113.** Write all the pairs of factors that make 36, and those that make 48, and pick out the greatest number that is a divisor of both.

**114.** In the same way find the greatest common divisor of 42 and 54, 36 and 60, 48 and 72.

**115.** What is the ratio of 18 to 6? 30 to 6? 6 to 54?

**116.** 18 pencils will cost how many times as much as 6 pencils? If 6 pencils cost 5 cents, how much will 18 pencils cost? 30 pencils? 24 pencils? 42 pencils?

**117.** How much is $\frac{1}{2}$ of $\frac{1}{6}$? $\frac{1}{3}$ of $\frac{1}{6}$? $\frac{3}{4}$ of $\frac{1}{6}$? $\frac{3}{10}$ of $\frac{5}{6}$?

**118.** How many times are 4 and 6 each contained in their least common multiple?

**119.** How many days in $3\frac{1}{7}$ weeks? In $4\frac{2}{7}$ weeks? In $8\frac{3}{7}$ weeks? In $9\frac{4}{7}$ weeks?

**120.** Add: $8\frac{4}{7}$ $5\frac{2}{7}$ $8\frac{3}{7}$   **121.** From $82\frac{5}{7}$ $92$ $54$

            $6\frac{2}{7}$ $7\frac{6}{7}$ $5\frac{5}{7}$     take $46\frac{3}{7}$ $57\frac{1}{7}$ $49\frac{2}{7}$

**122.** Multiply $5\frac{1}{7}$    $9\frac{2}{7}$    $7\frac{5}{7}$    $8\frac{1}{7}$    $21\frac{1}{7}$    $96\frac{1}{7}$

         by    8       6       7       8      22      12

**123.** 7 men have equal shares in a gold mine. They take from it in one year $17,355 worth of gold. How much is each man's share?

**124.** At 7% how much is the interest of a dollar for 5 years? $2\frac{1}{2}$ years? 3 years and 6 months?

**125.** At 7% interest how long would it take a dollar to gain 28 cents? 42 cents? 84 cents? 63 cents?

**126.** How many sq. in. in a rectangle 7 in. long and $5\frac{1}{7}$ in. wide?

**127.** How many sq. in. in a right triangle whose base is 7 in. and altitude $5\frac{1}{7}$ in.?

**128.** How many cu. in. in a 7-inch cube? How many sq. in. in all its surfaces?

**129.** Make lists of all the factors of 42 and 56, and find the greatest number that is contained in both of them.

**130.** In the same way find the greatest common divisor of 42 and 63, 35 and 70, 21 and 42, 28 and 56.

**131.** Name a multiple of 7 that is a perfect square. What is its square root?

**132.** How much is $\frac{1}{2}$ of $\frac{1}{7}$? $\frac{2}{3}$ of $\frac{1}{7}$? $\frac{3}{4}$ of $\frac{2}{7}$? $\frac{5}{6}$ of $\frac{3}{7}$?

**133.** What is the ratio of 7 to 14? 7 to 42? 35 to 7? 49 to 7? 28 to 7? 63 to 7?

**134.** 14 tops will cost how many times as much as 7 tops of the same kind? If 7 tops cost 10 cents, how much will 14 tops cost? 21 tops? 35 tops? 28 tops?

**135.** Name two numbers whose greatest common divisor is 8. Tell how many times 8 is contained in each of them.

**136.** Name three numbers whose greatest common divisor is 8, and tell how many times each of them contains 8.

**137.** Name a multiple of 8 which is a perfect square. What is its square root?

**138.** How many quarts in 3 pecks? In a bushel? In $5\frac{1}{2}$ pk.? $10\frac{5}{8}$ pk.? $4\frac{1}{4}$ pk.? $7\frac{3}{4}$ pk.? $20\frac{1}{4}$ pk.?

**139.** How many pecks in 9 quarts? 21 qt.? 37 qt.? 46 qt.? 58 qt.? 63 qt.? 77 qt.? 89 qt.?

**140.** How many 8ths in 3 whole ones? In $4\frac{1}{8}$? $6\frac{3}{8}$? $7\frac{7}{8}$? $5\frac{1}{8}$? $9\frac{5}{8}$? $12\frac{3}{8}$? $8\frac{5}{8}$?

**141.** Mr. Kent works in a factory where 8 hours make a day's work. How many hours does he work in a week? In 10 weeks?

**142.** How many sq. in. in an 8-inch square? In a rectangle whose base is 8 in. and altitude $6\frac{1}{2}$ in.? In a right triangle whose base is 8 in. and altitude $6\frac{1}{2}$ in.?

**143.** How many cu. in. in an 8-inch cube?

**144.** How many sq. in. in all the surfaces of an 8-inch cube?

**145.** Add: $41\frac{1}{8}$  $75\frac{1}{8}$  **146.** From $28\frac{7}{8}$  $76\frac{5}{8}$  $9$

  $51\frac{2}{8}$ or $\frac{1}{4}$  $31\frac{1}{4}$   take  $19\frac{1}{8}$  $41\frac{3}{8}$  $6\frac{1}{8}$

**147.** Find product: $31\frac{1}{8}$  $8\frac{3}{8}$  $21\frac{5}{8}$  $6\frac{7}{8}$  $4\frac{1}{8}$  $6\frac{1}{8}$  $9\frac{1}{8}$

  $5$   $3$   $4$   $2$   $12$   $13$   $14$

**148.** Find $\frac{1}{8}$ of $\$245.76$. Of $\$334.32$. Of $\$676.24$. Of $\$889.60$. Of $\$498.48$.

**149.** If $\$7288$ were divided among 8 men, how much would each man receive?

**150.** At 8%, how much is the interest of a dollar for 5 years? 7 yr. and 6 mo.? 9 yr. and 6 mo.? 11 yr. and 6 mo.?

**151.** How much is $\frac{1}{2}$ of $\frac{1}{8}$? $\frac{2}{3}$ of $\frac{3}{8}$? $\frac{5}{6}$ of $\frac{3}{8}$? $\frac{6}{7}$ of $\frac{7}{8}$?

**152.** What is the ratio of 8 to 16? 48? 32? 96? 72?

**153.** What is the ratio to 8 of 48? 64? 40? 56? 88?

**154.** 24 pencils will cost how many times as many cents as 8 pencils?  When 8 pencils are sold for 4 cents, how many cents will 24 pencils cost?  40 pencils?  56 pencils?

**155.** How many sq. ft. in 3 sq. yd.?  $6\frac{1}{3}$ sq. yd.?  $3\frac{1}{2}$ sq. yd.?  $4\frac{1}{2}$ sq. yd.?  $7\frac{2}{3}$ sq. yd.?  $8\frac{2}{3}$ sq. yd.?

**156.** If there are 9 squares in a row, how many rows are needed to make a rectangle containing 54 squares?  72 squares?  96 squares?  63 squares?

**157.** What is the square of 9?  What is the square root of 9?  Of what number is 9 the square root?

**158.** How many cu. in. in a 9-inch cube?

**159.** How many sq. in. in the whole surface of a 9-inch cube?

**160.** Add:   $9\frac{1}{9}$   $2\frac{2}{9}$   $8\frac{5}{9}$     **161.** From $9\frac{7}{9}$   $9\frac{8}{9}$   $76\frac{7}{9}$
$9\frac{2}{9}$   $3\frac{4}{9}$   $3\frac{5}{9}$     take $1\frac{4}{9}$   $4\frac{5}{9}$   $29\frac{5}{9}$
$9\frac{4}{9}$   $5\frac{7}{9}$   $7\frac{5}{9}$

**162.** Florence's mother bought 33 yd. of calico, and used $11\frac{1}{9}$ yd. in making a dress.  How many yd. were left?

**163.** Make problems in which you use fractions.

**164.** Multiply:   $9\frac{1}{9}$   $9\frac{2}{9}$   $7\frac{4}{9}$   $1\frac{8}{9}$   $9\frac{5}{9}$   $27\frac{1}{9}$   $38\frac{1}{9}$   $29\frac{1}{9}$
     4    5    6    7    8    24    29    9

**165.** There are $18\frac{1}{9}$ acres in a farmer's field.  How many acres would there be in 27 such fields?

**166.** Find quotients :   $9)\$758.79$     $9)\$239.71$
     $9)\$998.47$     $9)\$621.34$

**167.** 9 boys owned a boat worth $218.70.  How much was each boy's share worth?

**168.** Write two numbers of which 9 is the greatest common divisor, and tell the number of times 9 is contained in each.

**169.** A man bought a lot for $500, built a house for $1000, and a stable for $200. He sold the property for $3560. Did he gain or lose, and how much?

**170.** 27 marbles will cost how many times as much as 9 marbles at the same rate? When 9 marbles are sold for 5 cents, how much will 27 marbles cost? 36? 63? 81?

**171.** Name the multiples of 9 until you reach one that is also a multiple of 6. What name is given to the smallest number that exactly contains both 9 and 6?

**172.** Find the least common multiple of 9 and 5, 9 and 4, 9 and 8.

**173.** How much is $\frac{1}{2}$ of $\frac{1}{9}$? $\frac{3}{7}$ of $\frac{7}{9}$? $\frac{3}{5}$ of $\frac{5}{9}$? $\frac{6}{7}$ of $\frac{8}{9}$?

**174.** Find sums:          **175.** Find differences:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| $7\frac{1}{10}$ | $6\frac{3}{10}$ | $8\frac{7}{10}$ | $9\frac{9}{10}$ | $7\frac{9}{10}$ | $6\frac{9}{10}$ | $9\frac{9}{10}$ | $8\frac{9}{10}$ |
| $9\frac{1}{10}$ | $1\frac{7}{10}$ | $2\frac{3}{10}$ | $2\frac{7}{10}$ | $1\frac{7}{10}$ | $4\frac{1}{2}$ | $5\frac{1}{5}$ | $4\frac{2}{5}$ |
| $4\frac{7}{10}$ | $9\frac{9}{10}$ | $8\frac{9}{10}$ | | | | | |

**176.** Mr. Wilson had $24\frac{9}{10}$ acres of land, and sold $21\frac{1}{2}$ acres. How many acres had he left?

**177.** Multiply   35      375      25      15      13
          by    10      10      100      1000      10000

**178.** Give a short way of multiplying a number by 10. By 100. By 1000. Make some examples and explain.

**179.** Multiply   24      41      82      51      212
          by    20      300      400      5000      30000

**180.** Make some examples like the above, and tell how you multiply when the multiplier ends in naughts.

**181.** Find products:

$339\frac{1}{10}$      $462\frac{1}{10}$      $596\frac{1}{10}$      $463\frac{3}{10}$      $558\frac{7}{10}$      $661\frac{2}{10}$      $287\frac{1}{10}$
   10          120          20          30          10          50          60

**182.** If it takes $5\frac{1}{10}$ yd. of bunting to drape a window, how many yd. will it take for 8 windows?

**183.** If it takes $7\frac{9}{10}$ yd. of bunting to drape a door, how many yd. will it take for 4 doors?

**184.** Divide : $10\overline{)3270}$.

After dividing in the usual way, lead the children to see that the same result will be obtained by cutting off the naught in the units' place.

**185.** Divide by 10 in the shortest way: 4280, 3270, 47500.

**186.** Make examples and show how you divide by 10 any number that ends in naught.

**187.** Make examples and show how you would divide by 100 any number that ends in 2 naughts.

**188.** Make examples and show how you can divide by 1000 any number that ends in 3 naughts.

**189.** At 6 cents a square foot, how much will it cost to sod a square yard of the lawn? 15 sq. yd.? 30 sq. yd.?

**190.** If the binding used costs 10 cents a foot, how much will it cost to bind a rug 1 yd. square? 2 yd. square?

**191.** If you put $10 into a bank that pays 3%, and take none out, how much will you have in the bank at the end of 6 years? 12 years? 18 years?

**192.** Mary bought 9 yd. of lace at 8 cents a yd., and handed the clerk 75 cents. How much change should she receive?

**193.** Make problems about buying and making change.

**194.** A boy picked 2 gal. of berries on Saturday and 3 gal. on Monday. He sold them for 10 cents a qt. How much did he get for them?

**195.** Divide 12078 by $\frac{1}{4}$ of 236.

**196.** Name three numbers of which 10 is the greatest common divisor.

**197.** Find factors of 40 and 60, and pick out the greatest common factor.

**198.** Name in order the multiples of 9 until you find one that is also a multiple of 4. By it divide 432, 1296, and 2592.

**199.** What is the least common multiple of 10 and 4? 10 and 7? 10 and 6? 10 and 8? 10 and 12?

**200.** $\frac{1}{2}$ of $\frac{1}{10} = ?$ $\frac{1}{2}$ of $\frac{1}{10}$ of a dollar = how many cents? $\frac{1}{5}$ of $\frac{1}{10}$ of a dollar = how many cents? $\frac{1}{10}$ of $\frac{1}{10}$ of a dollar = how many cents?

**201.** 40 oranges will cost how many times as much as 10 oranges? If 10 oranges cost 25 cents, how much will 40 oranges cost? 20? 50? 70? 90?

**202.** How many cu. in. in a 10-inch cube? How many sq. in. in its surface? How many in. long are all its edges taken together?

**203.** How many sq. in. in a rectangle 10 in. long and $9\frac{1}{2}$ in. wide? How long is its perimeter?

**204.** The perimeter of a square is 40 in. How long is one side? How many sq. in. in the square?

**205.** A rectangle is 10 in. long and its perimeter is 30 in. How wide is the rectangle and what is its area? Draw diagram.

**206.** John may draw a rectangle, not letting any one else see it. He may give its length and the length of its perimeter to the class. They may find the width of the rectangle and its area.

**207.** Mary may draw a rectangle and give its width and the length of its perimeter. The class may find the length of the rectangle and its area.

Let this exercise be general. Encourage the children to dispense with the drawing of the figure as soon as they are able to visualize it clearly.

**208.** What do you mean by $\frac{1}{11}$ of anything? Illustrate.

**209.** $\frac{3}{11}$ of a yd. of cloth and $\frac{9}{11}$ of a yd. and $\frac{10}{11}$ of a yd. = how many whole yd.?

**210.** How many 11ths in 2 whole ones? In 3? $4\frac{1}{11}$?

**211.** How many whole ones in $\frac{44}{11}$? $\frac{15}{11}$? $\frac{23}{11}$? $\frac{37}{11}$? $\frac{45}{11}$?

**212.** Find sums :      **213.** Find differences :

$$3\frac{1}{11} \qquad 7\frac{8}{11} \qquad 8\frac{4}{11} \qquad 47\frac{6}{11} \qquad 7 \qquad 6 \qquad 6$$

$$5\frac{6}{11} \qquad 1\frac{3}{11} \qquad 3\frac{9}{11} \qquad 8\frac{3}{11} \qquad 3\frac{1}{11} \qquad 4\frac{2}{11} \qquad 1\frac{3}{11}$$

**214.** From a piece of goods containing $8\frac{5}{11}$ yd., $3\frac{2}{11}$ yd. were cut off. How much remained?

**215.** Write products :

$$11 \quad 11 \quad 11 \quad 11 \quad 11 \quad 11 \quad 11 \quad 11 \quad 11$$

$$8\frac{1}{2} \quad 9\frac{1}{11} \quad 2\frac{1}{2} \quad 3\frac{1}{3} \quad 5\frac{1}{4} \quad 3\frac{1}{5} \quad 7\frac{1}{6} \quad 5\frac{1}{5} \quad 4\frac{2}{11}$$

**216.** How many sq. in. in a rectangle 11 in. long and $7\frac{1}{4}$ in. wide? How long is its perimeter?

**217.** Find area and perimeter of a rectangle 11 in. long and $3\frac{1}{3}$ in. wide.

**218.** How many sq. in. in a right triangle whose base is 11 in. and altitude 8 in.?

**219.** How many cu. in. in an 11-inch cube? How many sq. in. in all its surfaces? What is the length of all its edges taken together?

**220.** Write three numbers, of which 11 is the greatest common divisor.

**221.** How many sq. in. in a square foot? How many sq. ft. in 1584 sq. in.? 3024 sq. in.? 4752 sq. in.?

**222.** How many cu. in. in a cubic foot? How many cu. ft. in 19,008 cu. in.? 20,736 cu. in.? 25,920 cu. in.?

**223.** What is the least multiple of 11 that will contain 3? 7? 5? 8?

**224.** How much is $\frac{1}{2}$ of $\frac{1}{11}$? $\frac{3}{5}$ of $\frac{5}{11}$? $\frac{3}{7}$ of $\frac{4}{11}$?

**225.** Use 11 as a divisor with 462, 484, 572, 683, 782.

**226.** The expense of an excursion which cost $374 was shared equally by 11 men. How much did each man pay?

**227.** 33 yd. of cloth will cost how many times as much as 11 yd. at the same rate? If 11 chocolate drops cost 5 cents, how many can be bought for 10¢? For 15¢?

**228.** How much is $\frac{2}{3}$ of 12? $\frac{3}{4}$ of 12? $\frac{5}{6}$ of 12?

**229.** Multiply 12 by $6\frac{1}{2}$. By $4\frac{1}{3}$. $5\frac{1}{4}$. $2\frac{1}{6}$. $3\frac{1}{12}$.

**230.** How many 12ths in 3 whole ones? In $4\frac{7}{12}$? $2\frac{11}{12}$? $6\frac{5}{12}$? $8\frac{1}{12}$? $6\frac{7}{12}$? $9\frac{11}{12}$?

**231.** How many whole ones in $\frac{17}{12}$? In $\frac{23}{12}$? $\frac{27}{12}$? $\frac{40}{12}$?

**232.** Find sums :     **233.** Find differences :

| | | | | | | |
|---|---|---|---|---|---|---|
| $8\frac{1}{12}$ | $6\frac{7}{12}$ | $2\frac{11}{12}$ | $8\frac{11}{12}$ | $6\frac{1}{3}$ or $\frac{4}{12}$ | $9\frac{7}{12}$ | $7\frac{1}{6}$ |
| $8\frac{5}{12}$ | $8\frac{5}{12}$ | $6\frac{1}{12}$ | $2\frac{1}{2}$ | $3\frac{1}{12}$ | $6\frac{1}{3}$ | $1\frac{1}{12}$ |
| $6\frac{1}{4}$ or $\frac{3}{12}$ | $9\frac{1}{12}$ | $6\frac{11}{12}$ | 5 | 7 | 9 | 8 |
| $2\frac{1}{12}$ | $7\frac{1}{4}$ | $4\frac{1}{4}$ | $1\frac{1}{12}$ | $3\frac{5}{12}$ | $4\frac{7}{12}$ | $4\frac{11}{12}$ |

**234.** A farmer had $96\frac{11}{12}$ acres of woodland and $238\frac{1}{12}$ acres of cleared land. How many acres had he in all?

**235.** To 3 ft. and 4 in. add 2 ft. and 5 in., placing the work as below.

| ft. | in. |
|---|---|
| 3 | 4 |
| 2 | 5 |
| 5 | 9 *Ans.* |

**236. Add:**

| ft. | in. | ft. | in. | ft. | in. | ft. | in. |
|---|---|---|---|---|---|---|---|
| 7 | 4 | 4 | 11 | 6 | 8 | 9 | 8 |
| 3 | 7 | 3 | 1 | 2 | 5 | 1 | 7 |

| ft. | in. | ft. | in. | ft. | in. | ft. | in. |
|---|---|---|---|---|---|---|---|
| 21 | 3 | 16 | 8 | 8 | 9 | 10 | 9 |
| 8 | 10 | 5 | 9 | 2 | 7 | 4 | 6 |

**237. From** ... **take**

| ft. | in. | ft. | in. | ft. | in. | ft. | in. |
|---|---|---|---|---|---|---|---|
| 11 | 8 | 9 | 7 | 8 | 9 | 12 | 11 |
| 6 | 2 | 3 | 4 | 4 | 5 | 2 | 7 |

**238.** If you have a string 4 ft. long and cut off 1 inch, how many ft. and in. long is it then? How long is it when you have cut off 2 ft. more?

**239. From** ... **take**

| ft. | in. | ft. | in. | ft. | in. | ft. | in. |
|---|---|---|---|---|---|---|---|
| 4 | 0 | 7 | 0 | 8 | 0 | 9 | 0 |
| 2 | 1 | 2 | 3 | 4 | 6 | 3 | 8 |

**240.** A room is 12 ft. high. The border around the top of the wall is 1 ft. 6 in. wide. How far is the lower edge of the border from the floor?

**241.**

| ft. | in. |
|---|---|
| From 3 | 1 |
| take 0 | 5 |

Let this be illustrated by measurement if necessary.

**242.**

| | ft. | in. | ft. | in. | ft. | in. | ft. | in. | ft. | in. |
|---|---|---|---|---|---|---|---|---|---|---|
| From | 6 | 2 | 9 | 3 | 8 | 1 | 6 | 4 | 9 | 6 |
| take | 2 | 4 | 3 | 5 | 3 | 7 | 2 | 7 | 3 | 8 |

**243.** Arthur is 4 ft. 7 in. tall and Mary is 5 ft. 1 in. What is the difference in their heights?

**244.** How tall were you when you were 1 ft. and 6 in. shorter than you are now?

Make a general exercise by having the children measure the heights of their classmates or of different objects in the schoolroom, and find differences.

**245.**

| | ft. in. | ft. in. | ft. in. | ft. in. | ft. in. |
|---|---|---|---|---|---|
| Multiply: | 3 2 | 7 6 | 5 3 | 2 5 | 5 6 |
| | 5 | 2 | 4 | 3 | 4 |

| ft. in. | ft. in. | ft. in. | ft. in. | ft. in. | ft. in. |
|---|---|---|---|---|---|
| 7 8 | 12 10 | 9 7 | 10 6 | 5 7 | 9 2 |
| 2 | 3 | 4 | 6 | 5 | 8 |

**246.** How long is the perimeter of a square, one side of which is 5 ft. and 4 in.? 4 ft. 7 in.? 6 ft. 3 in.? 2 ft. 11 in.?

**247.** The long sides of a rectangle are each 4 ft. and 8 in. long. The short sides are 3 ft. and 4 in. How long is the perimeter?

**248.** Make problems about the perimeters of figures.

**249.** Mr. Wilson has a flower bed in the shape of a six-pointed star. See Fig. 3, p. 201. Each side of the points is 2 ft. and 6 in. long. How long is the perimeter of the flower bed?

**250.** How long is the perimeter of an equilateral triangle, one side of which is 5 ft. and 1 in. long.? 4 ft. 4 in.?

**251.** How many sides has a hexagon? On what page in your book can you find one?

**252.** Julia has a flower bed in the shape of an equilateral hexagon, bordered with pinks placed 1 ft. apart. Each side of the border is 2 ft. long. Draw a diagram of the flower bed, and find how many plants are in the whole border.

**253.** Add:

| yr. mo. | yr. mo. | yr. mo. | yr. mo. | yr. mo. | yr. mo. |
|---|---|---|---|---|---|
| 8 3 | 9 6 | 11 3 | 4 11 | 21 8 | 31 7 |
| 7 5 | 8 8 | 4 10 | 7 3 | 17 9 | 12 11 |

**254.** Helen is 11 yr. and 7 mo. old and Emma is 4 yr. and 8 mo. older than Helen. How old is Emma?

**255.** 3 yr. and 7 mo. ago Edwin was 8 yr. and 9 mo. old. How old is he now?

**256.** How old will you be in 2 yr. and 3 mo. from now?

**257.** Make problems about ages in years and months.

**258.**

| | yr. | mo. | yr. | mo. | yr. | mo. | yr. | mo. | yr. | mo. |
|---|---|---|---|---|---|---|---|---|---|---|
| From | 13 | 6 | 15 | 9 | 16 | 11 | 18 | 0 | 19 | 0 |
| take | 7 | 3 | 12 | 4 | 5 | 6 | 5 | 1 | 4 | 3 |

**259.** Albert is 13 yr. and 8 mo. old. How long before he will be 15 years old?

**260.**

| | yr. | mo. | yr. | mo. | yr. | mo. | yr. | mo. | yr | mo. |
|---|---|---|---|---|---|---|---|---|---|---|
| From | 36 | 1 | 48 | 2 | 37 | 7 | 24 | 5 | 31 | 4 |
| take | 2 | 3 | 12 | 5 | 13 | 9 | 19 | 8 | 24 | 9 |

**261.** How old were you 3 yr. and 2 mo. ago?

**262.** —— is —— yr. and —— mo. old, and —— is —— yr. and —— mo. old. Find difference between their ages.

For a general class exercise compare ages of different members of the class, disregarding days.

**263.**

| | yr. | mo. | yr. | mo. | yr. | mo. | yr. | mo. | yr. | mo. |
|---|---|---|---|---|---|---|---|---|---|---|
| Multiply: | 5 | 3 | 7 | 4 | 8 | 6 | 12 | 8 | 11 | 7 |
| | | 3 | | 3 | | 4 | | 3 | | 3 |

**264.** Harriet is 11 years and 6 months old. Her mother is three times as old. How old is her mother?

**265.** Make problems in which years and months are multiplied.

**266.** Divide by 13 each of the numbers between 2000 and 3000 that end in 97.

**267.** Mr. Anderson owns $\frac{1}{15}$ of a mine that paid one year $87,872. How much did he receive?

**268.** The next year the mine yielded only $6472. How much did he receive?

**269.** The next year the mine lacked $765 of paying expenses. How much did Mr. Anderson have to pay out?

**270.** Mr. Brown has a salary of $3500 a year. How much does he receive each month?

**271.** If he saves $125 every month, how much does he save in a year? How much will he save in 12 years?

**272.** A dealer in wagons paid $564 for a dozen wagons of the same kind. How much did each wagon cost?

**273.** If he gained $5.50 on each wagon, how much did he gain on the dozen?

**274.** Mr. West, who has a stationery store, bought 11 dozen tablets for $3.96. What was the price per dozen? How much did each tablet cost? If he sells them at $.05 each, how much does he gain on them all? The cost of one is in what ratio to the gain on one?

**275.** What is the ratio of 24 to 12? 48 to 12? 72 to 12? 36 to 12? 108 to 12?

**276.** 24 bicycles will cost how many times as much as 12 bicycles of the same kind? If a dozen bicycles cost $600, how much will 24 bicycles cost? 36? 48? 96? 72?

**277.** If a dozen bicycles cost $500, how many can be bought for $1500? For $2500? For $3500? For $4500? For $2000?

**278.** Square 14, 98, 195, 117.

**279.** If 84 men form a military company, how many companies can be formed by 1092 men? 1764 men?

Divide:

| | | | |
|---|---|---|---|
| **280.** | 46968 by 206 | **283.** | 939695 by 815 |
| **281.** | 88392 by 509 | **284.** | 12750 by 315 |
| **282.** | 634876 by 411 | **285.** | 12750 by 316 |

**286.** Multiply 212  611  423  671  1228  1728  6843
by 105  201  103  204  1004  1005  2001

0 in the quotient is the special difficulty of the following examples. Find quotients :

| | DIVIDENDS | DIVISORS | | DIVIDENDS | DIVISORS |
|---|---|---|---|---|---|
| **287.** | 22260 | 212 | **292.** | 84941 | 841 |
| **288.** | 122811 | 611 | **293.** | 178488 | 888 |
| **289.** | 43569 | 423 | **294.** | 48144 | 472 |
| **290.** | 136844 | 671 | **295.** | 71173 | 691 |
| **291.** | 12750 | 125 | **296.** | 198198 | 18 |

**297.** Mr. Hunt had $85\frac{1}{2}$ acres of corn, $108\frac{1}{2}$ acres of wheat, $2\frac{1}{4}$ acres of cabbage, 54 acres of oats, 13 acres of potatoes, $1\frac{1}{3}$ acres of radishes, and $15\frac{2}{3}$ acres of rye. How many acres of grain had he? How many acres of vegetables had he?

**298.** What is the ratio of 385 to 35? Of 462 to 42?

**299.** How many inch-cubes would it take to cover a square foot? How many layers of inch cubes to build a cubic foot? How many inch cubes to build a cubic foot?

**300.** How many cu. ft. in a coal bin which is 10 ft. long, 8 ft. wide, and 7 ft. high?

**301.** How many cu. ft. in a cellar 24 ft. long, 20 ft. wide, and 7 ft. deep?

**302.** How many cu. ft. in a ditch 40 ft. long, 5 ft. wide, and 3 ft. deep?

**303.** How many cu. ft. of air in a room 30 ft. long, 20 ft. wide, and 10 ft. high?

**304.** CLASS EXERCISE. ———— may think of a room that has four smooth walls, give its probable length, breadth, and height. The class may find how many cubic feet it contains.

**305.** 1 cent is what part of 1 dollar?

**306.** $\frac{1}{100}$ of anything is sometimes called 1% of it. What shall we call $\frac{3}{100}$? $\frac{7}{100}$? $\frac{99}{100}$? $\frac{100}{100}$ or the whole?

**307.** Have you ever stood 100% on an examination or test? What does 100% mean?

**308.** If you lacked 2% of being perfect on an examination, what % would you stand?

**309.** When a man loses 100 % of his money, what % of it has he left?

**310.** 7 cents is what % of a dollar? What % of a dollar is 9 cents? 13 cents? 21 cents? 99 cents?

**311.** $17 is what % of $100? What % of $100 is $19?

**312.** 9 inches is what % of 100 inches? What % of 100 inches is 31 inches? 41 inches? 1 yard and 1 inch?

**313.** If you get 6 cents' interest for every 100 cents you lend for a year, what %.are you getting?

**314.** Mr. Taylor gets 5 cents' interest each year for every dollar he lends. What % does he get? How much interest does he get each year for $7.00?

**315.** Point out numbers on the number table and tell what % they are of 100, and what % they lack of being equal to 100.

**316.** 50 cents is what part of a dollar? What % of a dollar?

**317.** 25 cents is what part of a dollar? What % of a dollar?

**318.** 75 cents is what part of a dollar? What % of a dollar?

**319.** $\frac{1}{2}$ of 100% = how many %?

**320.** How much is 50% of $\frac{1}{2}$ of 18? 50% of 24?

**321.** Turn to Fig. 2, page 201, and show 50% of the figure. Show 50% of Fig. 3, page 201. Of Fig. 2, page 189.

**322.** George had $10, and lost 50% of his money. How much did he lose, and how much had he left?

**323.** Mr. Hall is 6 feet high. The height of his son Charles is 50% of Mr. Hall's height. How tall is Charles?

**324.** Caroline's age is 50% of that of her teacher, who is 25 years old. How old is Caroline?

**325.** How much is 50% of 28? 280? 140? 360? 840?

**326.** 50% of a gallon = how many quarts? 50% of a pound = how many ounces? 50% of a peck = how many quarts? 50% of a ton = how many pounds? 50% of a foot = how many inches? 50% of a square foot = how many square inches? 50% of a cubic foot = how many cubic inches? 50% of a yard = how many feet? How many inches?

**327.** 50% of a square yard = how many square feet? How many square inches?

**328.** 3 is 50% of what? 7 is 50% of what? 11 is 50% of what? 13 is 50% of what?

**329.** John had 8 cents, and gained as much more. How much had he then? How much would he have had if he had gained only 50% as much more?

**330.** Thomas had 12 cents and gained 50% more. How much had he then?

**331.** —— may give a problem to the class about some one who had some money and gained 50%.

**332.** Find 50% of 10136 and divide it by 24.

**333.** Find 50% of 8148, and divide it by 32.

**334.** $\frac{1}{4}$ of 100% of anything = how many %?

**335.** Draw a circle and divide it into fourths. Write in each fourth the % which it is of the whole circle.



FIG. 2

**336.** Draw a square 2 inches long and show 25% of it. Show 25% of Fig. 5, page 158. Of Fig. 1, page 157.

**337.** Henrietta is 8 years old, and her little sister's age is 25% of hers. How old is her little sister?

**338.** Mr. Adams had $12 and lost 25% of it. How much did he lose, and how much had he left?

**339.** Find 25% of 40. 24. 36. 248. 432. 888.

**340.** 6 is 25% of what number?

**341.** 25 per cent of what number is 3? 5? 7? 12?

**342.** Richard had 20 cents and gained 25%. How much had he then?

**343.** Mr. Walker had $400 and lost 25% of it. How much had he then?

**344.** Make problems about some one who gained or lost 25% of a sum of money.

**345.** Find 25 % of 34272 and divide it by 43.

**346.** Find 25% of 8028 and divide it by 61.

**347.** When a man loses 25 % of his money, what % has he left? How many fourths of his money are left?

**348.** Draw a line 12 inches long and show 75% of it.

**349.** Show 75% of Fig. 2, page 189. Of Fig. 5, page 202.

**350.** Find some figures in the book that you can show 25% of. 50%. 75%.
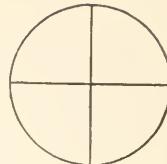
**351.** 75% of a gallon = how many quarts? 75 % of a bushel = how many pecks? 75 % of a pound = how many ounces?

**352.** Draw a rectangle 8 inches long and 2 inches wide, and show 75 % of it.

**353.** Show 75 % of these figures:

A rectangle 8 in. by 4 in.
A rectangle 4 in. by 3 in.
A 4-inch square.
A rectangle 10 in. by 4 in.

**354.** Ida's age is 75% of the age of Ella, who is 12 yr. old. How old is Ida?

**355.** Mr. Edwards' horse, Claybank, sold for 75 % of the price of another horse of his called Redtop. Redtop's price was $400. What was Claybank's price?

**356.** William had 20 cents and lost 75% of it. How much did he lose? How much had he left?

**357.** Arthur had 8 cents and gained 75%. How much had he then?

**358.** Thomas had 20 cents and gained 75%. How much had he then?

**359.** Make problems in which 75% of a sum of money is lost or gained.

**360.** Find amount of the following bill:

BOSTON, MASS., JAN. 3, 1898.

MR. THOMAS REED,

*Bought of* JAMES WILSON AND CO.,

| | | | |
|---|---|---|---|
| 12 lb. Coffee | at $ .30 | | ? |
| 4 lb. Butter | at .25 | | ? |
| 25 lb. Sugar | at .05 | | ? |
| 3 lb. Starch | at .15 | | ? |
| | | | ? |

Get billheads from local merchants. Let children make imaginary purchases of one another, copying the billheads, making out bills, and receipting them.

**361.** Lucy Wood is going to the country. Her mother bought 8 yards of gingham at $.11 a yard to make her a dress, and 2 yards of lace for it at $.24 a yard. She paid $1.75 for the making of the dress. How much did the dress cost?

**362.** She bought a hat for $.50, some flowers for $.35, and 3 yd. of ribbon at $.18 a yd. She paid the milliner $.50 for trimming the hat. How much did the hat cost?

**363.** She has bought a rain cloak for $3.75, an umbrella for $1.25, and a pair of rubbers for $.35. How much has Mrs. Wood spent to keep Lucy from getting wet?

**364.** Including $2.50 for a pair of shoes and $2.75 for a tennis racket, how much has Lucy's whole outfit cost?

For a class exercise let pupils find cost of preparing an outfit to go camping, to go to the city, to the seashore, to a picnic, etc. Let pupils suggest items and estimate cost.

**365.** Divide 2025 by the square root of 144.

**366.** Divide 89286 by the 9th multiple of 8.

**367.** Divide 30292 by the 8th multiple of 9.

**368.** Divide 1487 by the least common multiple of 9 and 8.

**369.** George Washington was born in MDCCXXXII. How old was he in the year in which the Declaration of Independence was signed?

**370.** Mary has a flower bed in the form of a square with 6 rose bushes on each side of the bed, but there are not 24 rose bushes in it. How many are there? Make dots to show the position of the rose bushes and count them unless you can think how they look.

# CHAPTER XVII

## FRACTIONS

**1.** Copy Fig. 1 by drawing, making each side of the figure 4 inches long. How many inch squares in your figure? Each square is what fractional part of the figure?
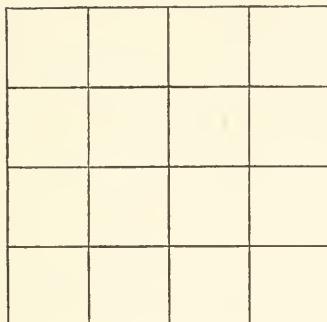
**2.** 3 squares are what part of the figure? 5 squares? 7 squares? 9 squares? 13 squares?

**3.** Show $\frac{1}{2}$ of Fig. 1. How many 16ths in $\frac{1}{2}$?



FIG. 1

**4.** Fill out the following by studying the parts of Fig. 1:

$\frac{1}{2} = \frac{?}{16}.$   $\frac{1}{4} = \frac{?}{16}.$   $\frac{3}{4} = \frac{?}{16}.$   $\frac{1}{8} = \frac{?}{16}.$   $\frac{3}{8} = \frac{?}{16}.$   $\frac{5}{8} = \frac{?}{16}.$

**5.** Show $\frac{1}{2}$ of Fig. 1. $\frac{1}{4}$ of Fig. 1. $\frac{1}{8}$ of Fig. 1.

**6.** Show $\frac{1}{2}$ of $\frac{1}{2}$ of the figure. What part of the figure is $\frac{1}{2}$ of $\frac{1}{2}$ of it?

**7.** Show $\frac{1}{2}$ of $\frac{1}{4}$ of Fig. 1. What part of the figure is $\frac{1}{2}$ of $\frac{1}{4}$ of it? Show $\frac{1}{4}$ of $\frac{1}{2}$ of the figure. What part of the whole is it?

**8.** Show $\frac{1}{4}$ of $\frac{1}{4}$ of Fig. 1. How much is $\frac{1}{4}$ of $\frac{1}{4}$?

**9.** Show $\frac{1}{8}$ of Fig. 1. Show $\frac{1}{2}$ of $\frac{1}{8}$ of it. $\frac{1}{2}$ of $\frac{1}{8} = ?$

**10.** Show $\frac{1}{8}$ of $\frac{1}{2}$ of it. What part of Fig. 1 is $\frac{1}{8}$ of $\frac{1}{2}$ of it?

**11.** Change your copy of Fig. 1 into a copy of Fig. 2 by drawing oblique lines.

**12.** How many right triangles in Fig. 2?

**13.** Each square is what part of Fig. 2? Each triangle is what part of a square? Each triangle is what part of Fig. 2? $\frac{1}{2}$ of $\frac{1}{16} = ?$



Fig. 2

**14.** The figure $ABCD$ is what part of the whole figure? One of the triangles is what part of $ABCD$? A triangle is what part of the whole figure? $\frac{1}{8}$ of $\frac{1}{4} = ?$

**15.** What name is given to a fraction of a fraction? How do you find the value of a fraction of a fraction?

Let children apply the rule to the preceding questions, and show that the same results are obtained by following the rule as by actually dividing the figures and counting their parts.

**16.** A single fraction is called a **Simple Fraction**. Express $\frac{1}{2}$ of $\frac{1}{16}$ by a simple fraction.

**17.** Change the following to equivalent simple fractions : $\frac{1}{2}$ of $\frac{1}{7}$, $\frac{1}{2}$ of $\frac{6}{7}$, $\frac{2}{3}$ of $\frac{6}{7}$, $\frac{5}{6}$ of $\frac{3}{7}$.

Explain the term "equivalent fractions."

**18.** Which is greater $\frac{2}{3}$ of $\frac{5}{7}$ or $\frac{10}{21}$? $\frac{3}{4}$ of $\frac{5}{7}$ or $\frac{15}{28}$? $\frac{4}{5}$ of $\frac{6}{7}$ or $\frac{27}{35}$?

**19.** Ernest rode $\frac{1}{2}$ mile on his bicycle, and Gertrude rode $\frac{1}{4}$ as far as he rode. What part of a mile did Gertrude ride?

**20.** Make problems that give compound fractions and find their value in simple fractions.
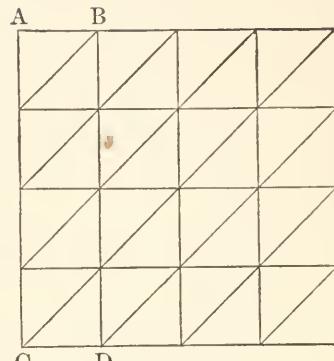
**21.** Reduce the following to equivalent simple fractions :

$\frac{3}{7}$ of $\frac{2}{9}$, $\frac{4}{7}$ of $\frac{7}{8}$, $\frac{8}{7}$ of $\frac{14}{24}$, $\frac{2}{9}$ of $\frac{18}{20}$, $\frac{6}{7}$ of $\frac{14}{18}$, $\frac{5}{7}$ of $\frac{14}{15}$, $\frac{8}{9}$ of $\frac{27}{72}$, $\frac{5}{6}$ of $\frac{12}{15}$, $\frac{3}{7}$ of $\frac{28}{27}$, $\frac{5}{6}$ of $\frac{3}{5}$ of $\frac{12}{15}$, $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{4}{5}$ of $\frac{5}{7}$.

**22.** $\frac{1}{2}$ of $\frac{2}{3}$ of $27 =$? $\frac{2}{5}$ of $\frac{5}{7}$ of $28 =$? $\frac{2}{9}$ of $\frac{6}{11}$ of $22 =$?

**23.** CLASS EXERCISE. —— —— may give a compound fraction, and the class may reduce it to an equivalent simple fraction.

**24.** How much is $\frac{1}{3}$ of $\frac{1}{3}$ of a square yard ? How many square feet ?

**25.** What part of a square foot is $\frac{7}{12}$ of $\frac{5}{12}$ of it ? How many square inches ?

**26.** John may start from one side of the schoolroom and walk a distance which he thinks is a rod. Another pupil may measure the distance to see how nearly right he is.

**27.** 320 rods make a mile. How many rods in $\frac{1}{8}$ of a mile ? $\frac{3}{8}$ ? $\frac{5}{8}$ ? $\frac{7}{8}$ ?

**28.** How many rods in $\frac{2}{3}$ of $\frac{9}{10}$ of a mile ? In $\frac{1}{2}$ of $\frac{3}{5}$ of $\frac{5}{16}$ of a mile ?

**29.** Mrs. Adams has money enough at interest to give her $288 interest every year. How much does her money earn in 6 mo. ? 3 mo. ? 9 mo. ?

**30.** If she had only $\frac{2}{3}$ as much money at interest, how much would she get from it each year ?

**31.** Her money is now at 6 % interest. If she had just as much money at interest, but the rate was only 1 %, how much interest would she receive each year ? How much is the interest of the same money for the same time at 3 % ? 5 % ? 7 % ? 9 % ?

**32.** Mr. Smith has just collected $872 interest from a note that had been gaining interest for 8 years. How much did it gain each year ? If it had been paid a year ago, how much interest should he have received ?

**33.** Make problems.

**34.** Recopy Fig. 2. Each square is what part of Fig. 2? Each triangle is what part of Fig. 2?

**35.** $\frac{1}{2}$ of Fig. 2 equals how many 16ths of it? How many 32ds of it?

**36.** Show $\frac{1}{4}$ of Fig. 2. How many 16ths in $\frac{1}{4}$ of Fig. 2? How many 32ds in $\frac{1}{4}$ of the figure?

**37.** Show $\frac{3}{4}$ of Fig. 2, and tell how many 16ths of it there are in $\frac{3}{4}$. How many 32ds of it there are in $\frac{3}{4}$?

**38.** Fill out the following by studying the parts of Fig 2:

$$\frac{1}{2} = \frac{?}{32}, \quad \frac{?}{16} \quad \frac{?}{8} \quad \frac{?}{4}. \qquad \frac{1}{8} = \frac{?}{32}, \quad \frac{?}{16}.$$

$$\frac{1}{4} = \frac{?}{32}, \quad \frac{?}{16} \quad \frac{?}{8}. \qquad \frac{3}{8} = \frac{?}{32}, \quad \frac{?}{16}.$$

$$\frac{3}{4} = \frac{?}{32}, \quad \frac{?}{16} \quad \frac{?}{8}. \qquad \frac{5}{8} = \frac{?}{32}, \quad \frac{?}{16}.$$

If the children have not discovered it for themselves, show them that the method of reducing a fraction to lower terms by dividing both terms of it by the same number, or raising it to higher terms by multiplying both terms by the same number, gives the same result as by dividing figures and counting the parts.

**39.** $\frac{1}{2}$ of anything equals how many 6ths of it? How many 8ths of it? How many 10ths? How many 12ths? How many 14ths? How many 20ths? How many 100ths?

Show that we may express the same fractional values by large numbers or by small numbers, provided that we do not change the ratio of the numerator and denominator.

**40.** Write a fraction whose denominator is 5 times its numerator and reduce it to lowest terms.

**41.** Write several fractions whose denominators are just twice the numerators. To what fraction is each one of those fractions equal?

**42.** Change $\frac{1}{2}$ to some equivalent fractions. Change $\frac{1}{3}$ to some equivalent fractions. Change $\frac{1}{5}$ to some equivalent fractions.

**43.** By what number must both terms of the fraction $\frac{2}{3}$ be multiplied to change it to $\frac{6}{9}$? Which is the greater, $\frac{2}{3}$ or $\frac{6}{9}$?

**44.** Change $\frac{4}{5}$ to 15ths and tell by what number you multiplied both terms. How do you find out by what number both terms must be multiplied?

**45.** Change the following fractions to higher terms and tell in each case by what number you multiplied each term: $\frac{2}{7}$ to 21sts. $\frac{5}{6}$ to 12ths. $\frac{3}{4}$ to 20ths. $\frac{2}{3}$ to 24ths. $\frac{5}{7}$ to 28ths.

**46.** Sometimes we let $x$ stand for a number that we are trying to find. Write out the following, putting the true number in the place of $x$:

$\frac{5}{7} = \frac{x}{21}$. $\quad$ $\frac{3}{4} = \frac{x}{40}$. $\quad$ $\frac{5}{8} = \frac{x}{24}$. $\quad$ $\frac{5}{9} = \frac{x}{18}$. $\quad$ $\frac{7}{11} = \frac{x}{33}$. $\quad$ $\frac{4}{5} = \frac{x}{35}$.

$x$ is no more difficult in this place than the interrogation point.

**47.** CLASS EXERCISE. — One of the girls may give a fraction. One of the boys may mention a higher denominator that it may have, and the class may change it so that it has that denominator.

**48.** Which is the greater, $\frac{1}{2}$ of a foot or $\frac{6}{12}$ of it? $\quad$ $\frac{1}{2}$ of an apple or $\frac{7}{14}$ of it? $\quad$ $\frac{1}{2}$ of a dollar or $\frac{50}{100}$ of it?

**49.** $\frac{1}{100}$ of anything is what % of it?

**50.** Which is greater, $\frac{1}{2}$ of a sum of money or 49% of it?

**51.** Change $\frac{1}{4}$ to hundredths, and write it as %. Change $\frac{3}{4}$ to %. $\frac{1}{5}$ to %. $\frac{4}{5}$ to %. $\frac{1}{10}$ to %. $\frac{7}{10}$ to %. $\frac{9}{10}$ to %.

**52.** CLASS EXERCISE. ——— may give a fraction that he can change to 100ths or %, and some one else may change it.

**53.** Change to 18ths: $\frac{5}{6}$, $\frac{1}{3}$, $\frac{7}{9}$, $\frac{1}{2}$. Why can you not change these fractions to 17ths?

**54.** Find a denominator to which all these fractions can be changed, and change them: $\frac{1}{6}$, $\frac{3}{4}$, $\frac{2}{3}$.

**55.** The least common multiple of the denominators is the most convenient denominator. What is the least common multiple of the denominators of $\frac{1}{2}$, $\frac{1}{3}$, and $\frac{1}{4}$? Change these fractions to 12ths.

**56.** Find the least common multiple of the denominators of the fractions $\frac{1}{5}$ and $\frac{2}{3}$, and reduce them to equivalent fractions that have it for their denominator.

**57.** Give a common denominator to $\frac{4}{9}$, $\frac{1}{2}$, and $\frac{2}{3}$ without changing their values.

**58.** Without changing values give common denominators to $\frac{2}{3}$, $\frac{3}{4}$, $\frac{4}{5}$. To $\frac{2}{5}$, $\frac{1}{2}$, $\frac{3}{10}$. To $\frac{3}{4}$, $\frac{2}{9}$, $\frac{5}{6}$, $\frac{1}{12}$. To $\frac{2}{3}$, $\frac{3}{5}$, $\frac{4}{15}$. To $\frac{3}{8}$, $\frac{1}{4}$, $\frac{2}{3}$, $\frac{5}{8}$. To $\frac{11}{12}$, $\frac{1}{8}$, $\frac{1}{3}$. To $\frac{1}{4}$, $\frac{3}{5}$, $\frac{7}{10}$. To $\frac{1}{7}$, $\frac{2}{5}$. To $\frac{3}{8}$, $\frac{1}{5}$, $\frac{9}{10}$. To $\frac{8}{9}$, $\frac{1}{27}$, $\frac{1}{3}$. To $\frac{5}{8}$, $\frac{5}{6}$, $\frac{2}{3}$, $\frac{3}{4}$.

**59.** CLASS EXERCISE. —— —— may write on the board two fractions, neither of whose denominators is greater than 12, and the class may change them to the same denominator without changing the value of either of them.

**60.** As we raise fractions to higher terms by multiplying both terms of the fraction by the same number, so we may bring them to lower terms. How?

**61.** Write the true number in the place of $x$:

$\frac{4}{8} = \frac{x}{2}$. $\frac{18}{21} = \frac{x}{7}$. $\frac{10}{18} = \frac{x}{9}$. $\frac{12}{22} = \frac{x}{11}$. $\frac{30}{40} = \frac{x}{4}$. $\frac{15}{24} = \frac{x}{8}$. $\frac{28}{35} = \frac{x}{5}$.

**62.** Reduce the following to lower terms, and tell by what number you divide the terms of each fraction :

$\frac{4}{8}$, $\frac{7}{14}$, $\frac{3}{9}$, $\frac{3}{11}$, $\frac{5}{15}$, $\frac{4}{10}$, $\frac{7}{11}$, $\frac{6}{8}$, $\frac{11}{21}$, $\frac{25}{30}$, $\frac{35}{40}$, $\frac{70}{100}$, $\frac{25}{100}$, $\frac{95}{100}$.

**63.** What number must both terms of $\frac{22}{33}$ be divided by to reduce that fraction to lowest terms?

**64.** What is the largest number that will divide both 22 and 33. What name do we give to the largest number that will divide two numbers?

**65.** Divide both terms of $\frac{5}{10}$ by their greatest common divisor. Which is the greater, the fraction you get or $\frac{5}{10}$? Which is in higher terms?

**66.** Divide both terms of $\frac{33}{44}$ by their greatest common divisor. What have you done to the fraction $\frac{33}{44}$?

**67.** Reduce the fraction $\frac{8}{16}$ to its lowest terms. What number is the greatest common divisor of both terms?

**68.** Reduce to lowest terms, and tell what common divisor you use with each fraction: $\frac{6}{8}$, $\frac{24}{32}$, $\frac{16}{32}$, $\frac{12}{32}$, $\frac{4}{8}$, $\frac{2}{16}$, $\frac{4}{16}$, $\frac{8}{32}$, $\frac{20}{32}$, $\frac{10}{16}$, $\frac{10}{32}$, $\frac{28}{32}$.

**69.** If you cannot see the greatest common divisor at first, and if, after dividing, your fraction is not in its lowest terms, what can be done about it?

**70.** Reduce to lowest terms:

$\frac{15}{30}$, $\frac{18}{30}$, $\frac{25}{30}$, $\frac{48}{60}$, $\frac{30}{45}$, $\frac{27}{81}$, $\frac{18}{36}$, $\frac{27}{54}$, $\frac{80}{100}$, $\frac{55}{100}$, $\frac{35}{100}$.

**71.** Change 50% to a fraction in its lowest terms.

**72.** Change to a fraction in its lowest terms: 25%, 75%, 20%, 40%, 60%, 80%, 30%, 70%, 90%, 45%, 55%, 35%.

**73.** Which is more, 15% of a dollar, or $\frac{3}{20}$ of it? 23% of a dollar, or $\frac{1}{5}$ of it? 31% of a dollar, or $\frac{3}{10}$ of it?

**74.** CLASS EXERCISE. —— may name a number of %, and the class may reduce the expression to a fraction in its lowest terms.

**75.** Can you reduce $\frac{3}{5}$ to lower terms? Explain.

**76.** How do you reduce a fraction to lower terms?

**77.** What is the use of reducing fractions to lower terms?

**78.** Write $\frac{5}{10}$ in its lowest terms, and then change it to 14ths.

**79.** Put $\frac{3}{9}$ into its lowest terms, and then change it to 21sts.

**80.** Bring $\frac{6}{8}$ to its lowest terms, and then to 12ths.

**81.** Change $\frac{9}{12}$ to its lowest terms, and then to 100ths.

**82.** Change $\frac{11}{22}$ to its lowest terms, and then to %.

**83.** Change to its lowest terms and then to % : $\frac{6}{8}$, $\frac{14}{28}$, $\frac{4}{16}$, $\frac{27}{36}$, $\frac{11}{44}$, $\frac{66}{88}$.

**84.** What is the ratio of 15 to 20 expressed in its lowest terms ?

**85.** Express in its lowest terms the ratio of 4 oz. to a lb.   8 oz. to a lb.   12 oz. to a lb.   14 oz. to a lb.

**86.** Give ratio in lowest terms of 18 to 20.   28 to 21.   30 to 35.   40 to 50.   50 to 40.   45 to 50.   18 to 27.   45 to 36.   72 to 84.   16 to 20.   30 to 24.   48 to 54.

**87.** The flag of Company E, 159th Reg. Ind. Vol., is 72 inches long and 54 inches wide.   Express the ratio of its width to its length in lowest terms.   Express the ratio of its length to its width.

It is sometimes well to let the children take sides and see who can stand the longest without failure — giving fractions and reducing them to the lowest terms or to higher terms.

**88.** How many whole ones in $\frac{7}{2}$ ?   $\frac{10}{3}$ ?   $\frac{12}{5}$ ?   $\frac{13}{4}$ ?   $\frac{17}{6}$ ?

**89.** A fraction whose numerator is equal to or greater than its denominator is called an **Improper Fraction.** Find some improper fractions on page 156.

Show pupils that an improper fraction is merely a form of division with which they have been working for a long time.

**90.** Write an improper fraction whose numerator is 10, and find its value.

**91.** CLASS EXERCISE. —— —— may name an improper fraction, and the class may tell its value.

**92.** What kind of a fraction is $\frac{7}{6}$? What does it equal?

**93.** A number that consists of a whole number and a fraction is called a **Mixed Number**, as $1\frac{1}{6}$. Give some other mixed numbers.

**94.** In a mixed number, the whole number is called the integral part, and the fraction is called the fractional part. Give the integral part of the mixed number $3\frac{5}{8}$. Of $7\frac{1}{2}$. Of $6\frac{1}{4}$. Of $144\frac{1}{3}$.

**95.** Give some other mixed numbers and tell which is the integral and which is the fractional part of each.

**96.** Give a mixed number the integral part of which is 7.

**97.** Give a mixed number whose fractional part is $\frac{5}{6}$.

**98.** Can you see any reason why a number that is made of a whole number and a fraction is called a " mixed " number?

**99.** Change the improper fraction $\frac{4}{3}$ to an equivalent mixed number, or find how many whole ones in $\frac{4}{3}$.

**100.** Change to an equivalent mixed number: $\frac{7}{5}$, $\frac{11}{10}$, $\frac{13}{9}$, $\frac{9}{7}$, $\frac{11}{5}$, $\frac{15}{11}$, $\frac{24}{7}$, $\frac{30}{11}$, $\frac{22}{3}$, $\frac{17}{5}$, $\frac{25}{12}$, $\frac{16}{7}$, $\frac{55}{9}$, $\frac{73}{8}$, $\frac{41}{5}$, $\frac{59}{8}$, $\frac{49}{12}$.

**101.** Look at the definition of an improper fraction in Ex. 89 and tell whether or not $\frac{6}{6}$ is an improper fraction. How many whole ones does it equal?

**102.** Can you change the improper fraction $\frac{15}{3}$ to an equivalent mixed number? Explain.

**103.** Change to equivalent whole numbers the following improper fractions: $\frac{18}{6}$, $\frac{24}{12}$, $\frac{21}{7}$, $\frac{48}{6}$, $\frac{48}{8}$, $\frac{48}{12}$, $\frac{48}{4}$, $\frac{72}{9}$, $\frac{64}{8}$, $\frac{36}{9}$, $\frac{63}{9}$.

**104.** Write some fractions whose denominators are each 7 and whose numerators are multiples of 7, and change them to equivalent whole numbers.

**105.** $\frac{12}{6}$ of a pie are equal to how many whole pies? $\frac{18}{6}$? $\frac{30}{6}$? $\frac{42}{6}$? $\frac{72}{6}$?

**106.** Write some fractions whose denominators are each 8 and whose numerators are multiples of 8, and reduce them to equivalent whole numbers.

**107.** CLASS EXERCISE. ——— may give an improper fraction that can be reduced to a whole number, and the class may reduce it.

**108.** Give an improper fraction that can be reduced to a mixed number and reduce it.

**109.** Reduce to equivalent mixed numbers : $\frac{17}{8}$, $\frac{28}{5}$, $\frac{16}{3}$, $\frac{49}{8}$, $\frac{64}{9}$, $\frac{99}{12}$, $\frac{40}{7}$, $\frac{32}{9}$, $\frac{52}{12}$, $\frac{47}{5}$, $\frac{81}{11}$.

**110.** CLASS EXERCISE. ——— may give an improper fraction that can be reduced to a mixed number, and the class may reduce it.

**111.** Reduce to whole or mixed numbers : $\frac{17}{7}$, $\frac{24}{8}$, $\frac{31}{5}$, $\frac{61}{12}$, $\frac{48}{6}$, $\frac{48}{12}$, $\frac{48}{8}$, $\frac{50}{9}$, $\frac{70}{8}$, $\frac{37}{5}$, $\frac{61}{7}$.

**112.** Tell how you reduce an improper fraction to a whole or mixed number.

**113.** Reduce the following to equivalent mixed numbers by long division : $\frac{299}{17}$, $\frac{683}{41}$, $\frac{849}{54}$, $\frac{476}{23}$, $\frac{1000}{59}$, $\frac{3246}{75}$, $\frac{833}{24}$, $\frac{789}{32}$.

**114.** How many 7ths in 5 whole units? In 9 whole units? In 11? In 13? What kind of fractions have you been changing these whole numbers into?

**115.** How many 8ths of an inch in 3 inches? 6 in.? 9 in.? 4 in.? 12 in.? Into what form have you been changing these whole numbers?

**116.** Change 5 into an improper fraction whose denominator is 10, or find how many 10ths in 5.

**117.** Change 6 into an improper fraction whose denominator is 8. Into one whose denominator is 5. Into one whose denominator is 7.

**118.** Change 4 to 6ths. To 8ths. To 10ths. To 9ths. To 12ths.

**119.** Class Exercise. — John may name a whole number, and the class may reduce it to an improper fraction, with a denominator that Mary may choose.

**120.** How many 7ths in $2\frac{1}{7}$? In $4\frac{3}{7}$? In $5\frac{2}{7}$? In $8\frac{4}{7}$? In $6\frac{6}{7}$? Into what form have you been changing these mixed numbers?

**121.** Change into equivalent improper fractions: $5\frac{1}{2}$, $4\frac{1}{6}$, $7\frac{2}{3}$, $12\frac{1}{5}$, $3\frac{7}{11}$, $6\frac{5}{9}$, $8\frac{1}{5}$, $4\frac{5}{6}$, $10\frac{1}{4}$, $6\frac{7}{8}$, $9\frac{3}{5}$.

**122.** Write the following, putting the true numbers in the place of $x$: $7\frac{1}{3} = \frac{x}{3}$. $3\frac{3}{4} = \frac{x}{4}$. $6\frac{1}{2} = \frac{x}{2}$. $5\frac{5}{6} = \frac{x}{6}$. $4\frac{1}{9} = \frac{x}{9}$. $4\frac{2}{11} = \frac{x}{11}$. $9\frac{3}{7} = \frac{x}{7}$. $8\frac{7}{9} = \frac{x}{9}$. $7\frac{3}{11} = \frac{x}{11}$.

**123.** Give a mixed number whose fractional part is $\frac{1}{2}$, and reduce the mixed number to halves.

**124.** Give a mixed number whose fractional part is $\frac{2}{3}$, and reduce the mixed number to an equivalent improper fraction.

**125.** Give a mixed number whose integral part is 4, and reduce it to an equivalent improper fraction.

**126.** How do you reduce a mixed number to an improper fraction?

**127.** Reduce to equivalent improper fractions the following: $12\frac{1}{2}$, $62\frac{1}{2}$, $17\frac{3}{4}$, $41\frac{2}{3}$, $16\frac{2}{3}$, $33\frac{1}{3}$, $87\frac{1}{2}$, $37\frac{1}{2}$, $66\frac{2}{3}$, $31\frac{1}{4}$.

**128.** Class Exercise. —— may put a list of mixed numbers on the board, and the class may reduce them to improper fractions.

**129.** $\frac{5}{12}$ of a foot + $\frac{7}{12}$ of a foot + $\frac{11}{12}$ of a foot + $\frac{1}{12}$ of a foot equals how many feet?

**130.** $\frac{1}{8}$ of anything + $\frac{3}{8}$ of it + $\frac{3}{8}$ of it = what part of it?

**131.** Write four fractions whose denominator is 7 and find their sum.

**132.** CLASS EXERCISE. —— may give three fractions having the same denominator, and the class may find their sum. If the sum is an improper fraction, reduce it to a whole or mixed number.

**133.** From $\frac{9}{11}$ take $\frac{3}{11}$. $\quad \frac{8}{15} - \frac{2}{15} = ?$ $\quad \frac{9}{13} - \frac{4}{13} = ?$

**134.** Recopy Fig. 2, p. 233, and find from it how many 32ds of it $\frac{1}{2} + \frac{1}{32}$ equal.

**135.** Find from Fig. 2 the values of $x$ in the following equations, and write them in place of it: $\frac{1}{4} + \frac{1}{32} = \frac{x}{32}$. $\frac{3}{4} + \frac{1}{32} = \frac{x}{32}$. $\frac{1}{8} + \frac{1}{32} = \frac{x}{32}$. $\frac{3}{8} + \frac{1}{32} = \frac{x}{32}$. $\frac{5}{8} + \frac{1}{32} = \frac{x}{32}$. $\frac{7}{8} + \frac{1}{32} = \frac{x}{32}$. $\frac{1}{16} + \frac{1}{32} = \frac{x}{32}$. $\frac{3}{16} + \frac{1}{32} = \frac{x}{32}$. $\frac{5}{16} + \frac{1}{32} = \frac{x}{32}$. $\frac{7}{16} + \frac{1}{32} = \frac{x}{32}$. $\frac{9}{16} + \frac{1}{32} = \frac{x}{32}$. $\frac{10}{16} + \frac{1}{32} = \frac{x}{32}$. $\frac{11}{16} + \frac{1}{32} = \frac{x}{32}$. $\frac{12}{16} + \frac{1}{32} = \frac{x}{32}$.

**136.** How much does $\frac{15}{16} + \frac{1}{32}$ of Fig. 2 lack of being the whole figure?

**137.** Change each of the plus signs in Ex. 135 to a minus sign, and write the equations again, putting in the true numbers in place of $x$.

**138.** Can you find a shorter way of adding or subtracting fractions than by dividing a figure and counting the parts?

Bring out the idea that fractions must be reduced to the same denominator before adding them or subtracting one from another.

**139.** To change to 32ds by what number must both terms of $\frac{1}{8}$ be multiplied? $\frac{1}{4}$? $\frac{1}{16}$?

**140.** Find values of $x$ in the following equations, first reducing all fractions to 32ds:

$\frac{1}{2} + \frac{11}{32} = \frac{x}{32}$. $\frac{1}{4} + \frac{11}{32} = \frac{x}{32}$. $\frac{3}{4} - \frac{11}{32} = \frac{x}{32}$. $\frac{1}{8} + \frac{11}{32} = \frac{x}{32}$. $\frac{3}{8} + \frac{11}{32} = \frac{x}{32}$. $\frac{5}{8} - \frac{11}{32} = \frac{x}{32}$. $\frac{7}{8} - \frac{11}{32} = \frac{x}{32}$. $\frac{1}{16} + \frac{11}{32} = \frac{x}{32}$. $\frac{3}{16} + \frac{11}{32} = \frac{x}{32}$.

**141.** How many inches in 1 foot and 3 inches? What must you do with the 1 foot before you can add 3 inches?

**142.** To add $\frac{1}{2}$ and $\frac{1}{4}$, what must you change $\frac{1}{2}$ into? Why not change $\frac{1}{4}$ to halves? $\frac{1}{2} + \frac{1}{4} = ?$ $\frac{1}{2} - \frac{1}{4} = ?$

**143.** To add or subtract 4ths and 8ths, what common denominator must they have? $\frac{1}{4} + \frac{1}{8} = ?$ $\frac{1}{4} - \frac{1}{8} = ?$

**144.** Can you see the use of learning to reduce fractions to higher terms?

**145.** Find values of $x$ in the following: $\frac{1}{2} + \frac{1}{3} = \frac{x}{6}$. $\frac{1}{2} + \frac{1}{6} = \frac{x}{6}$. $\frac{1}{3} + \frac{1}{6} = \frac{x}{6}$. $\frac{2}{3} + \frac{1}{6} = \frac{x}{6}$. $\frac{1}{2} - \frac{1}{3} = \frac{x}{6}$. $\frac{1}{2} - \frac{1}{6} = \frac{x}{6}$.

**146.** Draw a circle, divide it into 6ths, and show that your work was right in the preceding example.

**147.** Divide the circle into 12ths, and prove your work after you have found the values of $x$ in the following:

$\frac{1}{2} + \frac{1}{12} = \frac{x}{12}$.  $\frac{1}{4} + \frac{1}{12} = \frac{x}{12}$.  $\frac{1}{3} + \frac{1}{12} = \frac{x}{12}$.  $\frac{1}{6} + \frac{1}{12} = \frac{x}{12}$.

$\frac{1}{3} + \frac{1}{4} = \frac{x}{12}$.  $\frac{1}{4} - \frac{1}{12} = \frac{x}{12}$.  $\frac{1}{3} - \frac{1}{12} = \frac{x}{12}$.  $\frac{1}{6} - \frac{1}{12} = \frac{x}{12}$.

$\frac{5}{6} + \frac{1}{12} = \frac{x}{12}$.  $\frac{2}{3} + \frac{1}{12} = \frac{x}{12}$.  $\frac{5}{6} - \frac{1}{12} = \frac{x}{12}$.  $\frac{2}{3} - \frac{1}{12} = \frac{x}{12}$.

$\frac{1}{3} + \frac{1}{4} - \frac{1}{6} = \frac{x}{12}$.    $\frac{1}{3} - \frac{6}{4} + \frac{1}{12} = \frac{x}{12}$.      $\frac{2}{3} - \frac{1}{4} + \frac{1}{6} = \frac{x}{12}$.

$\frac{1}{4} - \frac{1}{6} + \frac{5}{12} = \frac{x}{12}$.    $\frac{5}{6} - \frac{1}{4} - \frac{1}{3} = \frac{x}{12}$.    $\frac{5}{6} - \frac{1}{3} + \frac{1}{12} = \frac{x}{12}$.

**148.** Draw a rectangle 5 inches long and 2 inches wide, and prove your work after finding the values of $x$ in the following equations:

$\frac{1}{5} + \frac{1}{2} = \frac{x}{10}$.    $\frac{1}{5} - \frac{1}{10} = \frac{x}{10}$.    $\frac{1}{2} - \frac{1}{10} = \frac{x}{10}$.    $\frac{3}{10} - \frac{1}{5} = \frac{x}{10}$.

**149.** Divide each square of your rectangle into halves, and prove your results in the following:

$\frac{1}{2} + \frac{1}{20} = \frac{x}{20}$.    $\frac{1}{2} - \frac{1}{20} = \frac{x}{20}$.    $\frac{1}{10} + \frac{1}{20} = \frac{x}{20}$.    $\frac{1}{5} - \frac{1}{20} = \frac{x}{20}$.

**150.** In adding $\frac{1}{2}$ and $\frac{1}{20}$ why do you reduce $\frac{1}{2}$ to 20ths?

Lead the children to observe that in all this concrete work they have used as a common denominator the number that is the least common multiple of the denominators.

**151.** What is the least number that will contain 8 and 3? Change $\frac{1}{8}$ and $\frac{1}{3}$ to 24ths, and find their sum. Find their difference.

**152.** Change $\frac{1}{5}$ and $\frac{3}{8}$ to a common denominator, and add them. Find their difference.

**153.** Change to a common denominator and add:

$\frac{2}{7}$ and $\frac{1}{2}$. $\quad \frac{2}{3} + \frac{1}{4}$. $\quad \frac{1}{6} + \frac{2}{5}$. $\quad \frac{3}{7} + \frac{1}{4}$. $\quad \frac{1}{8} + \frac{2}{7}$. $\quad \frac{3}{10} + \frac{2}{3}$. $\quad \frac{1}{3} + \frac{3}{5}$.

**154.** Philip lost $\frac{1}{7}$ of his money and spent $\frac{1}{2}$ of it. What part of it had he left? If he had $14 to begin with, how much had he left?

**155.** Fred took a bicycle trip from his home to Indianapolis. In the first 5 days he rode $\frac{7}{10}$ of the distance. On the 6th day he rode $\frac{1}{20}$ of the distance. What part of the distance had he still to ride?

**156.** Arthur spent $\frac{1}{2}$ of his money at one time, and gave $\frac{1}{3}$ of it at another time. What part of it did he spend? What part of it had he left? If $2 was what he had left, how much had he at first?

**157.** Mrs. Sampson spends $\frac{2}{3}$ of the money she receives as interest for board and $\frac{1}{4}$ of it for clothes. What part of it has she left?

**158.** Mr. Perkins laid off $\frac{7}{8}$ of an acre for turnips, $\frac{1}{3}$ of an acre for tomatoes, and $\frac{1}{2}$ of an acre for peas. How many acres did he lay off for all?

**159.** Write two fractions that can be reduced to 20ths, and find their sum.

**160.** Write two fractions that can be reduced to 30ths, and find their difference.

**161.** A lady spent $\frac{1}{3}$ of her money on Monday, and $\frac{1}{6}$ of it on Tuesday. What part of her money did she spend, and what part had she left? If at first she had $18, how much did she spend on Monday? On Tuesday?

**162.** George spent $\frac{1}{2}$ of his money for a watch, and $\frac{1}{5}$ of it for a coat. What part did he spend and what part had he left? If he had $20 to begin with, how much had he left?

**163.** Out of a flock of chickens $\frac{1}{5}$ died, $\frac{1}{4}$ were sold, and $\frac{1}{10}$ were lost. What part of them were left? If there were 20 chickens in the first place, how many remained?

**164.** Find difference of $\frac{5}{7}$ and $\frac{3}{8}$. Find their sum.

**165.** A man bought $\frac{7}{8}$ of an acre of land, and sold $\frac{1}{6}$ of an acre to his brother. What part of an acre did he keep?

**166.** Mrs. Miller paid $\frac{1}{4}$ of a dollar for some butter, $\frac{1}{2}$ a dollar for some coffee, $\frac{3}{4}$ of a dollar for some sugar, and had $\frac{1}{2}$ a dollar left. How much had she at first?

**167.** A milkman left $\frac{1}{8}$ of a gallon of milk at one house, $\frac{3}{4}$ of a gallon at another, $\frac{3}{8}$ of a gallon at another. How many gallons of milk did he have in all?

**168.** A field is $\frac{1}{4}$ of a mile long and $\frac{1}{6}$ of a mile wide. What fraction of a mile is the difference between its length and its width?

**169.** Irene spent $\frac{1}{5}$ of an hour in school in writing, $\frac{3}{4}$ of an hour in preparing her geography lesson, and $\frac{1}{2}$ of an hour in reciting it. How much time did she spend in all?

**170.** If the session of school was 3 hours long, how much time had she left?

**171.** Find sums :

$$4\tfrac{1}{2} \qquad 8\tfrac{5}{8} \qquad 17\tfrac{7}{9} \qquad 8\tfrac{4}{5} \qquad 1\tfrac{3}{8} \qquad 9\tfrac{5}{7} \qquad 4\tfrac{6}{7} \qquad 8\tfrac{2}{7} \qquad 2\tfrac{1}{7} \qquad 8\tfrac{5}{11}$$
$$2\tfrac{3}{4} \qquad 3\tfrac{5}{6} \qquad 2\tfrac{4}{27} \qquad 7\tfrac{2}{3} \qquad 4\tfrac{5}{7} \qquad 4\tfrac{2}{3} \qquad 7\tfrac{3}{4} \qquad 9\tfrac{4}{5} \qquad 6\tfrac{5}{6} \qquad 4\tfrac{3}{7}$$

**172.** Find differences :

$$8\tfrac{3}{4} \qquad 5\tfrac{1}{6} \qquad 9\tfrac{2}{5} \qquad 8\tfrac{1}{7} \qquad 6\tfrac{2}{9} \qquad 5\tfrac{1}{3} \qquad 6\tfrac{5}{9} \qquad 8\tfrac{2}{11}$$
$$4\tfrac{1}{4} \qquad 3\tfrac{5}{6} \qquad 2\tfrac{4}{5} \qquad 3\tfrac{2}{7} \qquad 1\tfrac{8}{9} \qquad 1\tfrac{2}{3} \qquad 4\tfrac{7}{9} \qquad 4\tfrac{7}{11}$$

**173.** Mr. Turner had $83\frac{1}{2}$ acres of wheat, $78\frac{1}{5}$ acres of corn, and $13\frac{1}{3}$ acres of oats. How many acres had he in cultivation?

**174.** Mr. Green's Jersey cow Bova gave milk enough to make $17\frac{1}{2}$ lb. of butter in one week, $18\frac{3}{4}$ lb. the next week, $19\frac{1}{4}$ lb. the next week, and $18\frac{1}{2}$ lb. the next week. How much was her average weekly yield of butter?

**175.** Bova's price was $575. She and her calf, Good Boy, were sold for $600. What was the price of the calf? Find its ratio to the price of the cow.

**176.** Make problems in which fractions are added.

**177.** Find differences:

| From | $8\frac{1}{3}$ or $\frac{4}{12}$ | $9\frac{1}{3}$ | $7\frac{1}{4}$ | $6\frac{4}{7}$ | $9\frac{5}{6}$ | $4\frac{2}{3}$ | $6\frac{5}{8}$ | $8\frac{3}{5}$ | $7\frac{7}{9}$ |
|------|------|------|------|------|------|------|------|------|------|
| take | $3\frac{1}{4}$ or $\frac{3}{12}$ | $3\frac{1}{5}$ | $2\frac{1}{8}$ | $2\frac{1}{2}$ | $4\frac{1}{7}$ | $1\frac{1}{2}$ | $2\frac{1}{3}$ | $4\frac{1}{2}$ | $4\frac{1}{3}$ |

**178.** If the bread that you eat in 1 day requires 4 oz. of flour to make it, how many oz. of flour will you eat in a year of 365 days? How many lb.?

**179.** 196 lb. of flour make a barrel. If you ate 5 oz. of flour each day, how much less than a barrel would you eat in a leap year?

**180.** John rode on his bicycle to a town 28 miles away. He stopped to rest and found he had traveled $9\frac{3}{8}$ miles. How much farther had he to go?

**181.** After riding $6\frac{3}{8}$ miles farther, how many miles remained?

**182.** Multiply 6 by $\frac{1}{3}$. To multiply 6 by $\frac{1}{3}$ we take $\frac{1}{3}$ of 6. Multiply 24 by $\frac{1}{4}$. 18 by $\frac{1}{2}$. 27 by $\frac{1}{3}$. 30 by $\frac{1}{10}$.

**183.** Multiply $\frac{1}{3}$ by $\frac{1}{2}$. To multiply $\frac{1}{3}$ by $\frac{1}{2}$ we take $\frac{1}{2}$ of $\frac{1}{3}$. How much is $\frac{1}{2}$ of $\frac{1}{3}$?

**184.** $\frac{1}{3} \times \frac{5}{7} = ?$   $\frac{4}{5} \times \frac{5}{7} = ?$   $\frac{6}{11} \times \frac{22}{9} = ?$   $\frac{7}{8} \times \frac{16}{21} = ?$   $\frac{15}{44} \times \frac{11}{25} = ?$
$\frac{1}{2} \times \frac{2}{3} \times \frac{3}{4} = ?$   $\frac{5}{6} \times \frac{7}{8} \times \frac{6}{7} = ?$   $\frac{2}{9} \times \frac{6}{7} \times \frac{21}{2} = ?$   $\frac{3}{5} \times \frac{6}{7} \times \frac{5}{9} = ?$

**185.** CLASS EXERCISE. —— may give some fractions, and the class may find their product.

**186.** Give an improper fraction and tell what an improper fraction is.

**187.** A fraction that is not improper is, of course, proper. $\frac{4}{5}$ is a proper fraction. Compare its numerator and denominator and tell why it is a proper fraction.

**188.** Give a proper fraction whose denominator is 7. Give three other proper fractions that express 7ths.

**189.** Give four proper fractions that express 11ths.

**190.** Multiply a proper fraction by an improper fraction.

**191.** Find the product of two improper fractions and reduce this product to a whole or a mixed number.

**192.** Multiply a proper fraction whose denominator is an odd number by a proper fraction whose denominator is an even number.

**193.** Is 99% a proper or an improper fraction?

**194.** Reduce the mixed number $2\frac{5}{9}$ to 9ths and tell how you reduced it.

**195.** I wish to multiply the mixed number $2\frac{1}{4}$ by $\frac{2}{3}$. What must be done to the mixed number so that it may be multiplied by a fraction?

**196.** Reduce the mixed number $8\frac{1}{3}$ to an improper fraction and multiply it by $\frac{4}{5}$.

**197.** Reduce the mixed numbers $2\frac{1}{7}$ and $2\frac{4}{5}$ to improper fractions and find their product.

**198.** Reduce the following mixed numbers to improper fractions and find values of $x$:

$$2\frac{1}{5} \times 3\frac{1}{3} = x. \quad 2\frac{1}{3} \times 2\frac{1}{4} = x. \quad 3\frac{3}{5} \times 2\frac{1}{7} = x. \quad 4\frac{2}{3} \times 4\frac{1}{7} = x.$$

$$2\frac{6}{5} \times 1\frac{2}{15} = x. \quad 3\frac{1}{9} \times 2\frac{4}{7} = x. \quad 8\frac{1}{3} \times 3\frac{1}{5} = x. \quad 5\frac{5}{6} \times 3\frac{1}{7} = x.$$

**199.** How much will $2\frac{2}{5}$ pounds of soap cost at $12\frac{1}{2}$ cents a pound?

Find the cost of:

**200.** $5\frac{1}{5}$ tons of hay @ $12\frac{1}{2}$ dollars a ton.

**201.** $4\frac{1}{2}$ quarts of strawberries @ $8\frac{1}{3}$ cents a quart.

**202.** $3\frac{3}{5}$ acres of land @ $62\frac{1}{2}$ dollars per acre.

**203.** $1\frac{1}{2}$ dozen pencils @ $33\frac{1}{3}$ cents per dozen.

**204.** $3\frac{1}{5}$ quarts of milk @ $6\frac{1}{4}$ cents per quart.

**205.** $5\frac{2}{5}$ yards of carpet @ $66\frac{2}{3}$ cents per yard.

**206.** A whole number is called an **Integer**, as 4, 10, etc. Name two integers and give their product. Is the product an integer or a fraction?

**207.** Multiply $\frac{7}{20}$ by $\frac{16}{1}$. Does it make any difference in the result whether that multiplier is called 16 or $\frac{16}{1}$?

**208.** Multiply $\frac{7}{8}$ by 10. $\frac{9}{11}$ by 22. $\frac{5}{14}$ by 7. $\frac{8}{9}$ by 6. $\frac{7}{12}$ by 16. $\frac{3}{14}$ by 21. $\frac{7}{15}$ by 20. $\frac{7}{18}$ by 27. $\frac{13}{48}$ by 12.

**209.** Multiply 18 by $\frac{7}{12}$. 24 by $\frac{8}{15}$. 42 by $\frac{5}{7}$. 81 by $\frac{7}{9}$.

**210.** Write a fraction and multiply it by an integer.

**211.** Multiply an integer by a fraction.

**212.** When you wish to multiply a mixed number by an integer or an integer by a mixed number, do not reduce either of them to an improper fraction.

$$\text{Multiply } 7\frac{1}{2} \qquad\qquad \text{Multiply } 12$$
$$\text{by } \underline{8} \qquad\qquad\qquad \text{by } \underline{3\frac{1}{4}}$$

Why is it best not to reduce either of the numbers to an improper fraction?

**213.** How many rods in $2\frac{1}{2}$ miles? $3\frac{1}{4}$ miles? $7\frac{1}{8}$ miles?

**214.** How many minutes in $3\frac{1}{2}$ hours? $7\frac{2}{3}$ hours? $1\frac{3}{4}$ hours?

**215.** At $12\frac{1}{2}$ cents a yard, how much will 8 yards of lace cost?

**216.** At $37\frac{1}{2}$ cents a yard, how much will 15 yards of sheeting cost?

**217.** Tell how you multiply a mixed number by an integer.

**218.** Multiply $\frac{3}{7}$ by itself.

**219.** Square: $\frac{3}{5}$, $\frac{4}{7}$, $\frac{5}{9}$, $\frac{3}{11}$, $\frac{7}{10}$, $\frac{3}{8}$, $\frac{10}{11}$, $\frac{5}{6}$, $\frac{2}{3}$, $\frac{11}{12}$.

**220.** Square: $1\frac{2}{3}$, $3\frac{1}{2}$, $2\frac{2}{3}$, $1\frac{1}{6}$, $1\frac{3}{5}$, $1\frac{2}{7}$, $2\frac{1}{2}$, $4\frac{1}{2}$, $5\frac{1}{2}$.

**221.** How many yards long is a rod? Tell how you find the number of square yards in a square rod.

Let the square rod with its divisions be drawn on the floor of the schoolroom and remain until it is worn off.

**222.** How many square yd. in a sq. rd.? In $\frac{4}{5}$ of a sq. rd.? In $\frac{4}{11}$ of a sq. rd.? In $\frac{8}{33}$ of a sq. rd.? In $\frac{12}{55}$ of a sq. rd.?

**223.** How many ft. long is a rod? How many square feet in a square rod?

**224.** How many sq. ft. in $\frac{4}{5}$ of a sq. rd.? In $\frac{8}{11}$ of it? In $\frac{16}{33}$ of it? In $\frac{4}{121}$ of it?

**225.** How many yd. in the perimeter of a sq. rd.? How many ft.?

**226.** How many feet of fence will it take to inclose a burial lot 2 rd. square? How much will it cost at 50 cents a foot?

**227.** How many yd. of fence will inclose a lot 3 rd. square? How much will it cost at $1.75 a yd.?

**228.** Write an improper fraction whose denominator is 5, and change it to a whole or a mixed number.

**229.** Draw a line $\frac{1}{2}$ of an inch long, and see how many times a line $\frac{1}{4}$ of an inch long is contained in it. $\frac{1}{2} \div \frac{1}{4} = ?$

**230.** How many times is $\frac{1}{6}$ of a pie contained in $\frac{1}{2}$ of a pie ? $\frac{1}{2} \div \frac{1}{6} = ?$

**231.** Turn to Fig. 1 and show $\frac{1}{4}$ of it. Show $\frac{1}{16}$ of Fig. 1. How many times is $\frac{1}{16}$ contained in $\frac{1}{4}$ ? $\frac{1}{4} \div \frac{1}{16} = ?$

**232.** Each triangle is what part of Fig. 3 ? Show $\frac{1}{8}$ of Fig. 3. Show $\frac{1}{2}$ of it. How many times is $\frac{1}{8}$ contained in $\frac{1}{2}$ ? $\frac{1}{2} \div \frac{1}{8} = ?$



FIG. 3

Show that in dividing one fraction by another, the same result is obtained by inverting the divisor and multiplying, as by actually measuring off one part of an object upon another part, and counting the measurements.

**233.** Divide : $\frac{3}{4}$ by $\frac{3}{8}$. $\frac{5}{8}$ by $\frac{3}{4}$. $\frac{5}{9}$ by $\frac{1}{3}$. $\frac{7}{8} \div \frac{7}{16} = ?$ $\frac{9}{10} \div \frac{3}{5} = ?$ $\frac{7}{12} \div \frac{14}{13} = ?$ $\frac{11}{12} \div \frac{22}{15} = ?$ $\frac{3}{14} \div \frac{9}{7} = ?$

**234.** Write a fraction whose denominator is 7, and divide it by a fraction whose denominator is 14.

Class drills like the following are useful : " Take $\frac{2}{3}$, multiply it by 4, add $\frac{1}{3}$, reduce, add $\frac{1}{5}$, change to improper fraction, divide by 8, square, multiply by 5, add $\frac{1}{4}$, reduce, divide by 3, subtract $\frac{1}{8}$," etc.

**235.** Write an improper fraction and divide it by another improper fraction.

**236.** Write an improper fraction and divide it by a proper fraction.

**237.** Write a proper fraction and divide it by another proper fraction.

**238.** Write a mixed number, reduce it to an improper fraction, and divide it by some other fraction.

**239.** Reduce $3\frac{4}{7}$ to an improper fraction, and divide it by $\frac{5}{14}$.

**240.** Divide : $2\frac{4}{7}$ by $\frac{6}{5}$. $2\frac{5}{8}$ by $\frac{7}{12}$. $4\frac{3}{8}$ by $\frac{7}{4}$. $9\frac{3}{8}$ by $\frac{5}{16}$.

**241.** Reduce to improper fractions and divide : $9\frac{1}{3}$ by $3\frac{1}{2}$. $6\frac{1}{4}$ by $2\frac{1}{7}$. $16\frac{2}{3}$ by $6\frac{1}{4}$. $7\frac{2}{9}$ by $2\frac{3}{5}$. $8\frac{3}{4}$ by $3\frac{1}{8}$.
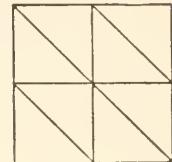
**242.** Reduce mixed numbers to improper fractions, and find values of $x$ :

$$8\tfrac{2}{5} \div 2\tfrac{1}{3} = x. \qquad 7\tfrac{3}{11} \div 5\tfrac{5}{7} = x. \qquad 8\tfrac{8}{9} \div 13\tfrac{1}{3} = x. \qquad 3\tfrac{3}{14} \div 2\tfrac{1}{7} = x.$$

$$4\tfrac{2}{7} \div 5\tfrac{5}{11} = x. \qquad 4\tfrac{1}{5} \div 4\tfrac{9}{10} = x. \qquad 4\tfrac{1}{3} \div 7\tfrac{2}{9} = x. \qquad 2\tfrac{1}{10} \div 5\tfrac{3}{5} = x.$$

$$5\tfrac{1}{5} \div 1\tfrac{3}{10} = x. \qquad 1\tfrac{7}{11} \div 5\tfrac{1}{7} = x. \qquad 7\tfrac{1}{7} \div 6\tfrac{2}{3} = x. \qquad 8\tfrac{1}{6} \div 2\tfrac{1}{3} = x.$$

**243.** Tell how you divide one fraction by another.

**244.** At $2\tfrac{1}{2}$ cents apiece, how many oranges can be bought for 15 cents ? 25 cents ? 40 cents ? 50 cents ?

**245.** At $3\tfrac{1}{3}$ cents, how many balls can be bought for $13\tfrac{1}{3}$ cents ? $33\tfrac{1}{3}$ cents ? $36\tfrac{2}{3}$ cents ? $43\tfrac{1}{3}$ cents ? $16\tfrac{2}{3}$ cents ?

**246.** At $6\tfrac{1}{4}$ cents per yard, how many yards of ribbon can be bought for 25 cents ? 50 cents ? 75 cents ?

**247.** At $8\tfrac{1}{3}$ cents per pound, how many pounds of rice can be bought for 25 cents ? 75 cents ? 50 cents ?

**248.** How much does the quotient of $\tfrac{7}{8} \div \tfrac{21}{4}$ lack of being equal to 1 ?

**249.** 1 is how much greater than the quotient of $\tfrac{5}{7} \div \tfrac{15}{14}$ ?

**250.** What is the sum of $\tfrac{2}{8}$ and $\tfrac{3}{4}$ ? What is their difference ? Product ? Quotient of greater divided by less ? Quotient of less divided by greater ?

**251.** Abraham Lincoln was born in MDCCCIX. How old was he in MDCCCLXV, the year in which he died ?

## DRY MEASURE

2 pints (pt.) = 1 quart (qt.).
8 quarts     = 1 peck (pk.).
4 pecks      = 1 bushel (bu.).

## LIQUID MEASURE

4 gills (gi.) = 1 pint (pt.).
2 pints      = 1 quart (qt.).
4 quarts     = 1 gallon (gal.).

## MEASURE OF TIME

60 seconds (sec.) = 1 minute (min.).
60 minutes       = 1 hour (hr.).
24 hours         = 1 day (da.).
7 days           = 1 week (wk.).
12 months        = 1 year (yr.).
365 or 366 days  = 1 year.

## LINEAR MEASURE

12 inches (in.) = 1 foot (ft.).
3 feet          = 1 yard (yd.).
$5\frac{1}{2}$ yards     = 1 rod (rd.).
$16\frac{1}{2}$ feet     = 1 rod.
320 rods        = 1 mile (mi.).

## AVOIRDUPOIS WEIGHT

16 ounces (oz.) = 1 pound (lb.).
2000 pounds     = 1 ton (T.).

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